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Aerospace Medicine and Biology
A Continuing Bibliography with Indexes

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AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 336)

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in April 1990 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*

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INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* lists 111 reports, articles and other documents announced during April 1990 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA).* The first issue of the bibliography was published in July 1964.

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. In general, emphasis is placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the bibliography consists of a bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR,* including the original accession numbers from the respective announcement journals. The *IAA* items will precede the *STAR* items within each category.

Seven indexes — subject, personal author, corporate source, foreign technology, contract, report number, and accession number — are included.

An annual index will be prepared at the end of the calendar year covering all documents listed in the 1990 Supplements.

Information on the availability of cited publications including addresses of organizations and NTIS price schedules is located at the back of this bibliography.

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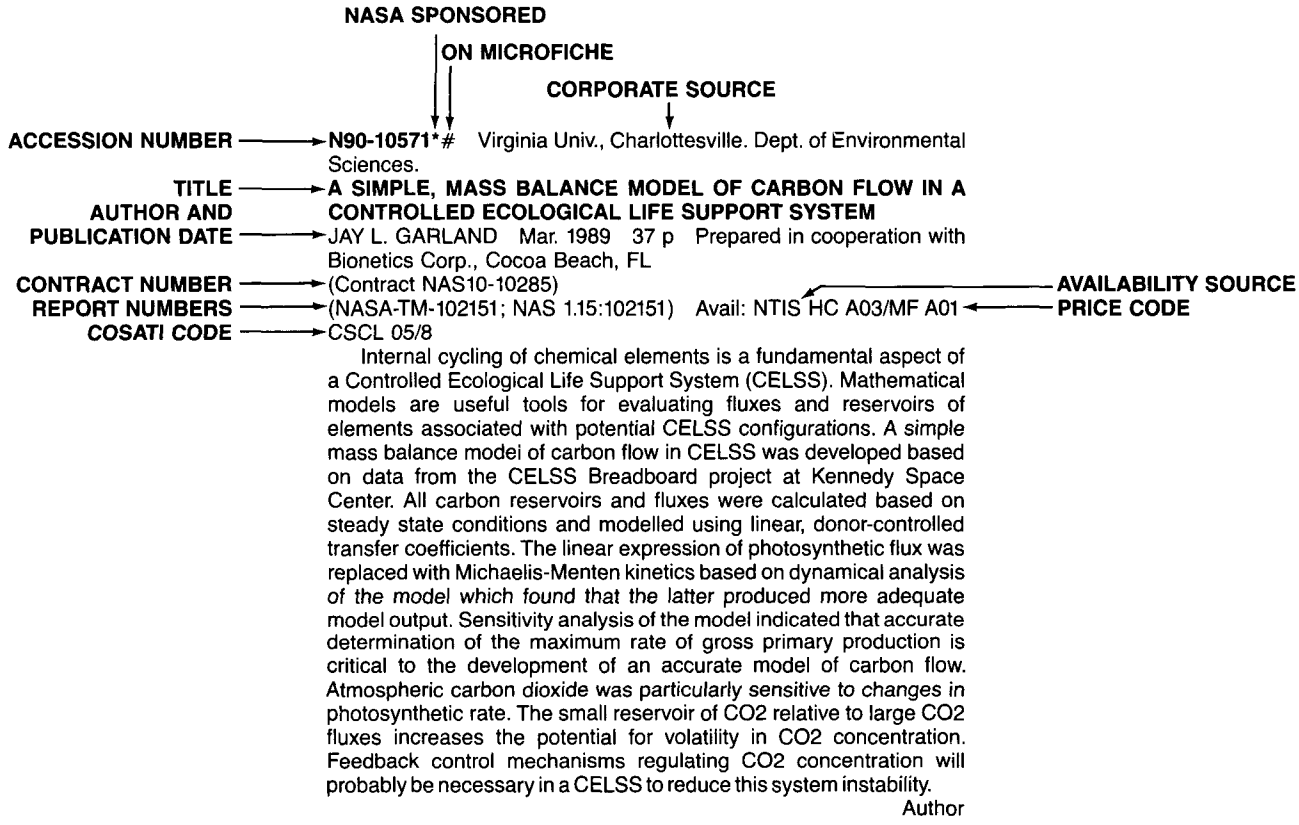
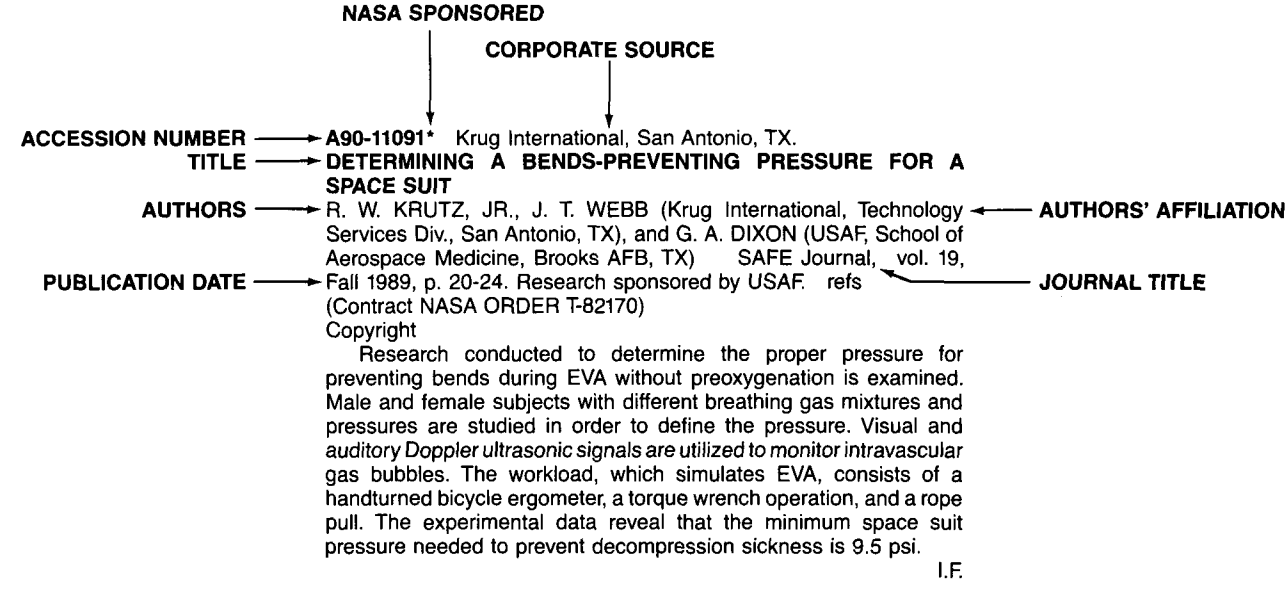


TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT



AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 336)

MAY 1990

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LIFE SCIENCES (GENERAL)

A90-20144
AMMONIA AND MONOAMINE CONCENTRATIONS IN TWO BRAIN AREAS IN RATS AFTER ONE HYPEROXIC SEIZURE
P. MIALON, J. CAROFF, L. BARTHELEMY, and J. C. BIGOT (Centre Hospitalier Universitaire, Brest, France) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Jan. 1990, p. 28-32. refs
Copyright

Monoamines (catecholamines, serotonin, and metabolites) and ammonia were studied within two areas of the rat brain - the frontal cortex (FC) and the striatum (SA) - after exposoure to hyperbaric oxygen (HBO) at 6 ATA up to the first seizure. An increase of norepinephrine (NE), dopamine (DA), and metabolites (HVA, DOPAC) measured by the HPLC/EC method were found in SA with a parallel increase of ammonia at variance with the FC where no monoamine changes, but a slight increase of ammonia, were found. Blood ammonia did not change with HBO. So, 20 min after one HBO seizure, there are regional differences in the brain, which are consistent with the previous findings of an SA start of electrocortical abnormalities at the onset of a seizure. Elevated DA, and possibly NE, levels may contribute to the accumulation of ammonia in the brain. During prolonged HBO exposure, this rise of ammonia could be one of the mechanisms involved in the relapse of seizures. It might also be implicated in initiation of the first seizure. By their situations and contents, SA glial cells could play an important role in brain HBO susceptibility.
Author

A90-20177* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
SULFUR, ULTRAVIOLET RADIATION, AND THE EARLY EVOLUTION OF LIFE
J. F. KASTING (NASA, Ames Research Center, Moffett Field, CA; Pennsylvania State University, University Park), K. J. ZAHNLE (NASA, Ames Research Center, Moffett Field, CA), J. P. PINTO (NASA, Ames Research Center, Moffett Field, CA; EPA, Research Triangle Park, NC), and A. T. YOUNG (San Diego State University, CA) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 19, no. 2, 1989, p. 95-108. refs
Copyright

The present biosphere is shielded from harmful solar near ultraviolet (UV) radiation by atmospheric ozone. It is suggested that elemental sulfur vapor could have played a similar role in an anoxic, ozone-free, primitive atmosphere. Sulfur vapor would have been produced photochemically from volcanogenic SO2 and H2S. It is composed of ring molecules, primarily S8, that absorb strongly throughout the near UV, yet are expected to be relatively stable against photolysis and chemical attack. It is also insoluble in water and would thus have been immune to rainout or surface deposition over the oceans. Since the concentration of S8 in the primitive atmosphere would have been limited by its saturation vapor pressure, surface temperatures of 45 C or higher, corresponding to carbon dioxide partial pressures exceeding 2 bars, are required to sustain an effective UV screen. A warm, sulfur-rich, primitive atmosphere is consistent with inferences drawn from molecular phylogeny, which suggest that some of the earliest organisms were thermophilic bacteria that metabolized elemental sulfur.
Author

A90-20179
CHEMICAL EVOLUTION OF DEHYDROGENASES - AMINO ACID PENTACYANOFERRATE (II) AS POSSIBLE INTERMEDIATES
MALA NATH KAMALUDDIN and SUSHAMA W. DEOPUJARI (Roorkee, University, India) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 19, no. 2, 1989, p. 119-132. Research supported by ISRO. refs
Copyright

Dehydrogenation of ascorbic acid and reduced nicotinamide adenine dinucieotide (NADH) with methylene blue, using complexes of the type (Fe/II/CN/5/L/)n- (where n = 3 or 4; L = glycine, histidine, imidazole, and triglycine) as catalyst have been studied at pH 9.18. Similar kinetic behavior was observed for the dehydrogenation of ascorbic acid as well as for NADH; both reactions showed first order dependency on the substrates. First-order dependence was observed only at lower concentrations of methylene blue; at higher concentrations, the reactions were independent of methylene blue. The order with respect to catalyst varied between 0.3-0.5. A tentative mechanism which conforms to the observed kinetics has been proposed. It is believed that, on the primitive earth, when the reducing potential of the atmosphere was not high enough, lower oxidation state iron complexes like amino-acid pentacyanoferrates (II) might have been involved in dehydrogenase-type activity.
Author

A90-20180
ON THE REACTION OF METHYLENEAMINOACETONITRILE IN AQUEOUS MEDIA
KATSUHIRO KAWASHIRO, KAZUHISA NISHIGUCHI, and TAKAYOSHI NARA (Tokushima, University, Japan) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 19, no. 2, 1989, p. 133-142. refs
Copyright

Methyleneaminoacetonitrile was found to give a number of products under mild hydrolytic conditions. The products identified by ion-exchange chromatography include iminodiacetic acid, iminodiacetonitrile, N-(cyanomethyl)glycine, N-(carbamoylmethyl) glycine, and N-(cyanomethyl)glycine amide along with glycine, aminoacetonitrile, and glycine amide. Compounds of biological significance such as peptides and hydroxy amino acids were not found. The results were well consistent with those obtained for aminoacetonitrile under similar conditions.
Author

A90-20181
PYROPHOSPHATE FORMATION FROM PHOSPHO(ENOL)PYRUVATE ADSORBED ONTO PRECIPITATED ORTHOPHOSPHATE - A MODEL FOR PREBIOTIC CATALYSIS OF TRANSPHOSPHORYLATIONS
MARCELO HERMES-LIMA and ADALBERTO VIEYRA (Rio de Janeiro, Universidade Federal, Brazil) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 19, no. 2, 1989, p. 143-152.

Research supported by FINEP and CNPq. refs

It has been postulated that adsorption and surface catalysis, as well as repeated drying and wetting cycles, were essential in the synthesis, interconversion, and coevolution of phosphorylated molecules, including 'energy-rich' compounds. The formation of pyrophosphate from phospho(enol)pyruvate and orthophosphate was investigated. The reaction occurred within hours at 37 C, required the adsorption of phospho(enol)pyruvate onto sedimented phosphate, exhibited Michaelian-like behavior, and showed positive cooperativity with respect to divalent cation concentration. Thus in 'mild', near-equilibrium conditions, the desolvated surfaces of phosphate crystals can catalyze the formation of pyrophosphate with a kinetic behavior similar to that found in contemporary enzymes. The experimental system described may represent a model for the prebiotic catalysis of transphosphorylations.

Author

A90-20182
THE ADSORPTION OF NUCLEOTIDES AND POLYNUCLEOTIDES ON MONTMORILLONITE CLAY

JAMES P. FERRIS, GOZEN ERTEM, and VIPIN K. AGARWAL (Rensselaer Polytechnic Institute, Troy, NY) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 19, no. 2, 1989, p. 153-164. refs
(Contract NSF CHE-85-06377)

Data are presented on the binding of mononucleotides and polynucleotides on montmorillonite clays and on interactions of bound mononucleotides with polynucleotides. It was found that the binding of adenine derivatives on Na(+)-montmorillonite increased in the order (5-prime-AMP, 3-prime-AMP, 5-prime-ADP), adenosine, purine, adenine and that, with the exception of cytosine, cytosine derivatives bound less strongly than the corresponding adenine analogs. Different binding trends were observed with Cu(2+)-montmorillonite, indicating that ligation to Cu(2+) was a major force in the binding of nucleotides to Cu(2+)-montmorillonite. When nucleotide homopolymers were bound to the surface of the clays, Watson-Crick hydrogen bonding of 5-prime-AMP to poly(U) and 5-prime-GMP to poly(C) was observed. I.S.

A90-20183* Salk Inst. for Biological Studies, San Diego, CA.
MODEL OF EARLY SELF-REPLICATION BASED ON COVALENT COMPLEMENTARITY FOR A COPOLYMER OF GLYCERATE-3-PHOSPHATE AND GLYCEROL-3-PHOSPHATE

ARTHUR L. WEBER (Salk Institute for Biological Studies, San Diego, CA) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 19, no. 2, 1989, p. 179-186. Previously announced in STAR as N89-23693. refs
(Contract NSG-7627)

Glyceraldehyde-3-phosphate acts as the substrate in a model of early self-replication of a phosphodiester copolymer of glycerate-3-phosphate and glycerol-3-phosphate. This model of self-replication is based on covalent complementarity in which information transfer is mediated by a single covalent bond, in contrast to multiple weak interactions that establish complementarity in nucleic acid replications. This replication model is connected to contemporary biochemistry through its use of glyceraldehyde-3-phosphate, a central metabolite of glycolysis and photosynthesis. Author

A90-20184
ON THE TRENDS IN PROTEIN MOLECULAR EVOLUTION - AMINO ACID COMPOSITION

ORLIN CH. IVANOV (B'lgarska Akademiia na Naukite, Institut po Organichna Khimiia s Tsent'r po Fitokhimiia, Sofia, Bulgaria) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 19, no. 2, 1989, p. 187-198. refs

The trends in protein molecular evolution were investigated using data on the amino acid composition of proteins from organisms representing different evolutionary levels; the mean contemporary protein composition was used as a basis for the comparison. The results obtained demonstrate the existence of a trend for a relative increase of Met, Ile, Gln, His, Lys, Asn, Phe, Tyr, Trp, and Cys at the expense of Thr, Pro, Ala, Ser, Arg, Gly, Leu, Val, Glu, and Asp. These results support the concept of a smaller number of amino acids in the ancient proteins and a respectively simpler genetic code. I.S.

A90-20391
POTENTIAL ROLE OF RABBITS AS A SUSTAINABLE ECOLOGICAL COMPONENT IN SPACE STATION VOYAGES

S. D. LUKEFAHR (Alabama Agricultural and Mechanical University, Huntsville) Huntsville Association of Technical Societies, Annual Technical and Business Exhibition and Symposium, 5th, Huntsville, AL, May 16, 17, 1989. 18 p. refs
(TABES PAPER 89-1516)

The biological potential of the rabbit as a meat-producing animal for long-term space missions is discussed. It is emphasized that rabbit is more efficient in forage protein utilization than most livestock, is in a constant state of reproduction, has a rapid growth rate, exhibits high degree of genetic diversity, is well suited to either large or small colonies, and that its meat is highly nutritious; the nonedible byproducts of the rabbit are rich in nutrient quality for plant culture and/or recycling. Data are presented on the nutrient requirements of the rabbit; the contents of minerals in urine; physiological parameters, including water and oxygen consumption; housing and environmental requirements; and possible human infection sources transmitted by rabbits. I.S.

A90-20456
RESONANCE EFFECT OF COHERENT MILLIMETER-RANGE ELECTROMAGNETIC RADIATION ON LIVING ORGANISMS [REZONANSNOE DEISTVIE KOGERENTNYKH ELEKTROMAGNITNYKH IZLUCHENII MILLIMETROVOGO DIAPAZONA VOLN NA ZHIVYE ORGANIZMY]

M. B. GOLANT Biofizika (ISSN 0006-3029), vol. 34, Nov.-Dec. 1989, p. 1004-1014. In Russian. refs

This paper examines biophysical mechanisms involved in the acute resonance effect of low-power millimeter-wave radiation, generated by living cells, on the functioning of the organism. Special attention is given to modeling the mechanism responsible for exciting coherent vibrations in living cells. I.S.

A90-20926* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
ELECTROPHORESIS AND ISOELECTRIC FOCUSING OF WHOLE CELL AND MEMBRANE PROTEINS FROM THE EXTREMELY HALOPHILIC ARCHAEBACTERIA

HELGA STAN-LOTTER, FRANK J. LANG, JR., and LAWRENCE I. HOCHSTEIN (NASA, Ames Research Center, Moffett Field, CA) Applied and Theoretical Electrophoresis (ISSN 0954-6642), vol. 1, no. 3, 1989, p. 147-153. refs
(Contract NCC2-578)

The subunits from two purified halobacterial membrane enzymes (ATPase and nitrate reductase) behaved differently with respect to isoelectric focusing, silver staining and interaction with ampholytes. Differential behavior was also observed in whole cell proteins from Halobacterium saccharovorum regarding resolution in two-dimensional gels and silver staining. It is proposed that these differences reflect the existence of two classes of halobacterial proteins. Author

A90-20983
DIAPHRAGM, GENIOGLOSSUS, AND TRIANGULARIS STERNI RESPONSES TO POIKILOCAPNIC HYPOXIA

ERIK VAN LUNTEREN, RICHARD J. MARTIN, MUSA A. HAXHIU, and WALDEMAR A. CARLO (Cleveland, University Hospitals; Case Western Reserve University, OH) Journal of Applied Physiology (ISSN 0161-7567), vol. 67, Dec. 1989, p. 2303-2310. refs
(Contract NIH-HL-38701; NIH-HL-25830)

Electromyograms were recorded from the diaphragm, genioglossus, and triangularis sterni muscles in nine anesthetized cats during polikilocapnic hypoxia. Consideration is given to the biphasic respiratory response elicited by isocapnic and poikilocapnic hypoxia (Easton et al., 1986). It is found that the response of triangularis sterni does not correlate with the responses of the diaphragm and genioglossus. The results suggest that there are both quantitative and qualitative differences among respiratory muscles in the stimulatory response to poikilocapnic hypoxia. R.B.

A90-20984
EFFECTS OF ACUTE HYPERBARIC OXYGENATION ON RESPIRATORY CONTROL IN CATS
D. TORBATI, A. MOKASHI, and S. LAHIRI (Pennsylvania, University, Philadelphia) Journal of Applied Physiology (ISSN 0161-7567), vol. 67, Dec. 1989, p. 2351-2356. refs
(Contract NIH-HL-19737-12)
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Ventilatory responsiveness to hypoxia and hypercapnia were studied in anesthetized cats before and after exposure to 5 atm absolute O2 for 90-135 min. The acute hyperbaric oxygenation (HBO) was terminated at the onset of slow labored breathing. Tracheal airflow, inspiratory and expiratory times, inspiratory tidal volume, end-tidal P(O2) and P(CO2) and arterial blood pressure were recorded simultaneously before and after HBO. The results show that part of the respiratory effects of HBO is due to pulmonary mechanoreflex changes. Author

A90-20985
VENTILATORY CONTROL DURING EXERCISE WITH PERIPHERAL CHEMORECEPTOR STIMULATION - HYPOXIA VS. DOMPERIDONE
S. L. SCHAEFER and G. S. MITCHELL (Wisconsin, University, Madison) Journal of Applied Physiology (ISSN 0161-7567), vol. 67, Dec. 1989, p. 2438-2446. refs
(Contract NIH-HL-36780; NIH-HL-01494)
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Results are presented from a comparison of the ventilatory responses of goats to treadmill exercise during hyperoxic control conditions, moderate hypoxia, and peripheral chemoreceptor stimulation with the peripheral dopamine D2-receptor antagonists, domperidone. Consideration is given to the role of the carotid chemoreceptors in the mechanism responsible for greater hypocapnia during hypoxic exercise. It is found that peripheral chemoreceptor stimulation via domperidone without hypoxia does not elicit this mechanism. R.B.

A90-21437
ENZYMATIC INCORPORATION OF A NEW BASE PAIR INTO DNA AND RNA EXTENDS THE GENETIC ALPHABET
JOSEPH A. PICCIRILLI, TILMAN KRAUCH, SIMON E. MORONEY, and STEVEN A. BENNER (Zuerich, Eidgenoessische Technische Hochschule, Zurich, Switzerland) Nature (ISSN 0028-0836), vol. 343, Jan. 4, 1990, p. 33-37. Research supported by Sandoz AG, SNSF, Eidgenoessische Technische Hochschule Zuerich, and Verband der Deutschen Chemischen Industrie. refs
Copyright

A new Watson-Crick base pair, with a hydrogen bonding pattern different from that in the A-T and G-C base pairs, is incorporated into duplex DNA and RNA by DNA and RNA polymerases and expands the genetic alphabet from 4 to 6 letters. This expansion could lead to RNAs with greater diversity in functional groups and greater catalytic potential. Author

A90-21524
OCCURRENCE OF MAGNETIC BACTERIA IN SOIL
JORG W. E. FASSBINDER (Muenchen, Universitaet, Munich, Federal Republic of Germany), HELGE STANJEK (Muenchen, Technische Universitaet, Freising, Federal Republic of Germany), and HOJATOLLAH VALI (McGill University, Montreal, Canada) Nature (ISSN 0028-0836), vol. 343, Jan. 11, 1990, p. 161-163. refs
Copyright

The discovery of living magnetic bacteria in the A horizon of a well-developed soil profile in a typical meadow environment in southern Bavaria is reported. The bacteria were detected in fresh samples using an optical microscope equipped with a rotating magnetic field and a volumetrically calibrated depression slide, permitting accurate counts of the volume density of the organisms. It is suggested that magnetic bacteria and their magnetofossils can contribute to the magnetic properties of soils. C.D.

A90-21730#
FACILITIES FOR CELL-BIOLOGY RESEARCH IN WEIGHTLESSNESS [FACILITEITEN VOOR CELBIOLOGISCH ONDERZOEK IN GEWICHTSLOOSHEID]
R. H. HUIJSER (Fokker Space and Systems, Amsterdam, Netherlands) Ruimtevaart, vol. 38, Oct. 1989, p. 45-55. In Dutch.

The history, current status, and future prospects of space cell-biology experimentation are reviewed, with an emphasis on Dutch contributions. Topics examined include the instrumentation required for space cell-biology facilities, the relationship between facility requirements and scientific goals, the Cells In Space (CIS) module for ESA sounding-rocket experiments, the successful flight of CIS-1 in April 1988, the Biorack flown on the first FRG Spacelab mission D-1 (November-December 1985), the smaller Biobox payload being developed for flights on the Soviet Biocosmos satellites, and the Columbus Biolab. Drawings, diagrams, and photographs of the CIS-1 launch and capsule recovery are provided. T.K.

A90-21731#
BIOLOGICAL PROCESSING IN SPACE [BIOPROCESSING IN DE RUIMTE]
F. ECKHARD (Comprimo, Netherlands) Ruimtevaart, vol. 38, Oct. 1989, p. 56-61. In Dutch.

The current status of research on space biological processing technology is reviewed, with a focus on the Dutch contributions to ESA programs and plans for the International Space Station. The advantages of the microgravity environment for protein crystallization, cell fusion, and electrophoresis are discussed, and the practical application of biofiltration to the waste-recycling process on manned space missions is described. T.K.

A90-21853
EFFECT OF VIBRATION ON THE IMPULSE ACTIVITY OF CORTICAL NEURONS AND THEIR RESPONSES TO THE STIMULATION OF THE POSTERIOR HYPOTHALAMUS AND THE VESTIBULAR DEITER NUCLEUS [VLIIANIE VIBRATSII NA IMPUL'SNUIU AKTIVNOST' KORKOVYKH NEIRONOV I IKH REAKTSII NA RAZDRAZHENIE ZADNEGO GIPOTALAMUSA I VESTIBULIARNOGO IADRA DEITERSA]
S. M. MINASIAN, O. G. BAKLAVADZHIAN, S. G. SAAKIAN, and N. K. MANUKIAN (Erevanskii Gosudarstvennyi Universitet, Yerevan, Armenian SSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 75, Oct. 1989, p. 1346-1354. In Russian. refs
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A90-21854
CANAL-OTOLITH INTERACTION IN THE PRESENCE OF OTOLITH ASYMMETRY [KANAL-OTOLITOVOE VZAIMODEISTVIE V USLOVIIAKH OTOLITOVOI ASIMMETRII]
IU. K. STOLBKOV (AN SSSR, Institut Fiziologii, Leningrad, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 75, Oct. 1989, p. 1381-1388. In Russian. refs
Copyright

The effect of otolith asymmetry on the direction and duration of rotatory nystagmus was investigated in intact pigeons position-fixed in special holders and exposed to horizontal rotations so that the position of the holder differed with respect to the axis of rotation, causing an asymmetry in the neuronal activities of paired brain centers stimulated by the otolith system. It was found that radial acceleration that caused otolith asymmetry during

simultaneous stimulation of semicircular canals and otolith organs acted to modify the direction of nystagmus as compared to controls. Thus, when the duration of the rightward nystagmus increased, the duration of the leftward nystagmus decreased, and vice versa. A possible mechanism for the formation of vestibulomotor reactions is proposed. I.S.

A90-21910* Arizona Univ., Tucson.
METABOLISM OF BRANCHED-CHAIN AMINO ACIDS IN LEG MUSCLES FROM TAIL-CAST SUSPENDED INTACT AND ADRENALECTOMIZED RATS
STEPHEN R. JASPERS, ERIK HENRIKSEN, STEPHAN JACOB, and MARC E. TISCHLER (Arizona, University, Tucson) Metabolism (ISSN 0026-0495), vol. 38, Feb. 1989, p. 109-114. refs
(Contract NAGW-227; NAG2-384)
Copyright

The effects of muscle unloading, adrenalectomy, and cortisol treatment on the metabolism of branched-chain amino acids in the soleus and extensor digitorum longus of tail-cast suspended rats were investigated using C-14-labeled lucine, isoleucine, and valine in incubation studies. It was found that, compared to not suspended controls, the degradation of branched-chain amino acids in hind limb muscles was accelerated in tail-cast suspended rats. Adrenalectomy was found to abolish the aminotransferase flux and to diminish the dehydrogenase flux in the soleus. The data also suggest that cortisol treatment increases the rate of metabolism of branched-chain amino acids at the dehydrogenase step. I.S.

A90-21911* Massachusetts Univ., Worcester.
EFFECTS OF STRETCHING AND DISUSE ON AMINO ACIDS IN MUSCLES OF RAT HIND LIMBS
STEPHEN R. JASPERS (Massachusetts, University, Worcester), ERIK J. HENRIKSEN (Washington University, Saint Louis, MO), SOISUNGWAN SATARUG (Khon-Kaen University, Thailand), and MARC E. TISCHLER (Arizona, University, Tucson) Metabolism (ISSN 0026-0495), vol. 38, April 1989, p. 303-310. refs
(Contract NAGW-227; NAG2-384)
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The effects of disuse and passive stretch on the concentrations of amino acids and ammonia in the unloaded soleus muscle was investigated in hindquarter-suspended (for six days by casting one foot in dorsiflexion) tail-casted rats. For a comparison with the condition of unloading, amino acids and ammonia were also measured in shortened extensor digitorum longus in the same casted limb and in denervated leg muscles. The results obtained suggest that passive stretch diminishes some of the characteristic alterations of amino acid concentrations due to unloading. This effect of stretch is considered to be due to the maintenance of muscle tension. I.S.

A90-21912* Rutgers Univ., New Brunswick, NJ.
EFFECTS OF OXYGEN DEPRIVATION ON INCUBATED RAT SOLEUS MUSCLE
JULIE M. FAGAN (Rutgers University, New Brunswick, NJ) and MARC E. TISCHLER (Arizona, University, Tucson) Life Sciences (ISSN 0024-3205), vol. 44, no. 10, 1989, p. 677-681. refs
(Contract NAG2-384)
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Isolated soleus muscle deprived of oxygen produces more lactate and alanine than oxygen-supplied muscle. Oxygenated muscle synthesized glutamine, while anoxic muscle used this amino acid. Oxygen deprivation decreased adenine nucleotides leading to the efflux of nucleosides. Protein synthesis and degradation responded differently to anoxia. Synthesis almost completely ceased, while proteolysis increased. Therefore, protein degradation in soleus muscle is enhanced when energy supplies and oxygen tension are low. Author

A90-21913* Medical Coll. of Wisconsin, Milwaukee.
IDENTIFYING MOTOR AND SENSORY MYELINATED AXONS IN RABBIT PERIPHERAL NERVES BY HISTOCHEMICAL STAINING FOR CARBONIC ANHYDRASE AND CHOLINESTERASE ACTIVITIES
DANNY A. RILEY, JAMES R. SANGER, HANI S. MATLOUB, N. JOHN YOUSIF, JAMES L. W. BAIN (Wisconsin, Medical College, Milwaukee) et al. Brain Research (ISSN 0006-8993), vol. 453, 1988, p. 79-88. refs
(Contract NAS2-11305)
Copyright

Carbonic anhydrase (CA) and cholinesterase (CE) histochemical staining of rabbit spinal nerve roots and dorsal root ganglia demonstrated that among the reactive myeliated axons, with minor exceptions, sensory axons were CA positive and CE negative whereas motor axons were CA negative and CE positive. The high specificity was achieved by adjusting reaction conditions to stain subpopulations of myelinated axons selectively while leaving 50 percent or so unstained. Fixation with glutaraldehyde appeared necessary for achieving selectivity. Following sciatic nerve transection, the reciprocal staining pattern persisted in damaged axons and their regenerating processes which formed neuromas within the proximal nerve stump. Within the neuromas, CA-stained sensory processes were elaborated earlier and in greater numbers than CE-stained regenerating motor processes. The present results indicate that histochemical axon typing can be exploited to reveal heterogeneous responses of motor and sensory axons to injury. Author

A90-21914* Medical Coll. of Wisconsin, Milwaukee.
QUANTITATION AND IMMUNOCYTOCHEMICAL LOCALIZATION OF UBIQUITIN CONJUGATES WITHIN RAT RED AND WHITE SKELETAL MUSCLES
DANNY A. RILEY, JAMES L. W. BAIN, ARTHUR L. HAAS (Wisconsin, Medical College, Milwaukee), and STANLEY ELLIS (NASA, Ames Research Center, Moffett Field, CA) Journal of Histochemistry and Cytochemistry (ISSN 0022-1554), vol. 36, no. 6, 1988, p. 621-632. refs
(Contract NCC2-266; PHS-GM-34009; NAS2-11305)
Copyright

Solid-phase immunochemical methods were employed to probe the dynamics of ubiquitin pools within selected rat skeletal muscles. The total ubiquitin content of red muscles was greater than that of white muscles, even though the fractional conjugation was similar for both types of muscles. The specificity for conjugated ubiquitin in solid-phase applications, previously demonstrated for an affinity-purified antibody against SDS-denatured ubiquitin, was retained when used as a probe for ubiquitin-protein adducts in tissue sections. Immunohistochemical localization revealed that differences in ubiquitin pools derived from the relative content of red (oxidative) vs white (glycolytic) fibers, with the former exhibiting a higher content of ubiquitin conjugates. Subsequent immunogold labeling demonstrated statistically significant enhanced localization of ubiquitin conjugates to the Z-lines in both red and white muscle fiber types. Author

A90-21915* Medical Coll. of Wisconsin, Milwaukee.
CATALASE-POSITIVE MICROPEROXISOMES IN RAT SOLEUS AND EXTENSOR DIGITORUM LONGUS MUSCLE FIBER TYPES
DANNY A. RILEY, JAMES L. W. BAIN (Wisconsin, Medical College, Milwaukee), and STANLEY ELLIS (NASA, Ames Research Center, Moffett Field, CA) Journal of Histochemistry and Cytochemistry (ISSN 0022-1554), vol. 36, no. 6, 1988, p. 633-637. refs
(Contract NCC2-266)
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The size, distribution, and content of catalase-reactive microperoxisomes were investigated cytochemically in three types of muscle fibers from the soleus and the extensor digitorum longus (EDL) of male rats. Muscle fibers were classified on the basis of the mitochondrial content and distribution, the Z-band widths, and the size and shape of myofibrils as the slow-twitch oxidative (SO), the fast-twitch oxidative glycolytic (FOG), and the fast-twitch

glycolytic (FG) fibers. It was found that both the EDL and soleus SO fibers possessed the largest microperoxisomes. A comparison of microperoxisome number per muscle fiber area or the microperoxisome area per fiber area revealed following ranking, starting from the largest number and the area-ratio values: soleus SO, EDL SO, EDL FOG, and EDL FG. I.S.

A90-21916* Medical Coll. of Wisconsin, Milwaukee.
CONTRACTION-FREE, FUME-FIXED LONGITUDINAL SECTIONS OF FRESH FROZEN MUSCLE
DANNY A. RILEY and GLENN R. SLOCUM (Wisconsin, Medical College, Milwaukee) Stain Technology (ISSN 0038-9153), vol. 63, no. 2, 1988, p. 93-96. refs
(Contract NAS2-11305)

Contraction damage occurring when longitudinal frozen sections of fresh unfixed muscles are thawed on microscope slides has limited histological examination of this tissue mainly to cross sections. Longitudinally oriented sections are advantageous for investigating properties that vary along the length of the muscle fibers. A fume fixation technique has been developed for preventing contraction of thick longitudinal frozen sections. The technique is compatible with histochemical staining of enzymes. Author

A90-21998* Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
IDENTIFICATION OF THE METHYLHOPANES IN SEDIMENTS AND PETROLEUM
ROGER E. SUMMONS (Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia) and LINDA L. JAHNKE (NASA, Ames Research Center, Moffett Field, CA) Geochimica et Cosmochimica Acta (ISSN 0016-7037), vol. 54, Jan. 1990, p. 247-251. refs

Three C31 mehylhopanes were synthesized from diplopterol and its 2-alpha-methyl (Me), 2-beta-Me, and 3-beta-Me analogs. These synthetic methylhopanes were then compared with hopanoids from a variety of bitumens by means of gas chromatography and mass spectrometry, demonstrating that all three C31 hydrocarbons may occur in the ancient sediments. The most common type of hopanes, which eluted very close to the corresponding hopane in the mature sediments and oils was the 2-alpha-Me series. I.S.

A90-22094
MAGNETIC IRON-SULPHUR CRYSTALS FROM A MAGNETOTACTIC MICROORGANISM
MARCOS FARINA (Rio de Janeiro, Universidade Federal, Brazil), DARCI MOTTA S. ESQUIVEL, and HENRIQUE G. P. LINS DE BARROS (CNPq, Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, Brazil) Nature (ISSN 0028-0836), vol. 343, Jan. 18, 1990, p. 256-258. Research supported by CNPq and FINEP. refs

The discovery of magnetic iron-sulfur crystals in a highly motile multicellular aggregate of bacteria found in brackish water with sulfide-rich sediments is reported. The iron sulfide crystals are enveloped by amorphous ore weakly crystalline regions rich in iron and oxyxgen, and these regions are surrounded by a membrane forming the magnetosome. The oxygen-rich regions may be involved in growth of the iron sulfide crystals. The magnetosomes are found in planar groups inside the cytoplasm of each cell in the aggregate. Magnetic iron sulfide may be a source of remnant magnetization in sediments and soils. C.D.

A90-22095
BIOMINERALIZATION OF FERRIMAGNETIC GREIGITE (FE3S4) AND IRON PYRITE (FES2) IN A MAGNETOTACTIC BACTERIUM
STEPHEN MANN, NICHOLAS H. C. SPARKS (Bath, University, England), RICHARD B. FRANKEL (California Polytechnic State University, San Luis Obispo), DENNIS A. BAZYLINSKI, and HOLGER W. JANNASCH (Woods Hole Oceanographic Institution, MA) Nature (ISSN 0028-0836), vol. 343, Jan. 18, 1990, p. 258-261. Research supported by SERC, NSF, and U.S. Navy. refs

The intracellular biomineralization of single crystals of the ferrimagnetic iron sulfide, greigite (Fe3S4), in a multicellular, magnetotactic bacterium common in brackish, sulfide-rich water and sediment is reported. It is shown that these crystals are often aligned in chains and associated with single crystals of the nonmagnetic mineral, iron pyrite. These results have important implications for understanding biomineralization processes and magnetoaxis in microorganisms inhabiting sulfidic environments. Furthermore, the biogenic production of magnetic iron sulfides should be considered as a possible source of remanent magnetization in sediments. C.D.

A90-22746
THERMOREGULATION AND THE SYMPATHETIC NERVOUS SYSTEM [TERMOREGULIATSIIA I SIMPATICHESKAIA NERVNAIA SISTEMA]
VALERII N. GURIN Minsk, Izdatel'stvo Nauka i Tekhnika, 1989, 232 p. In Russian. refs

This book examines the role of the sympathetic nervous system (SNS) in the maintenance of life-supporting functions in endothermic organisms under extreme temperature. Results are presented on experimental studies investigating the effects of cold, heat, pyrogenic substances, and drugs on the activity of the SNS, and the mechanisms involved in these effects are discussed. The role of SNC and catecholamines in the orientation of certain metabolic processes in febrile conditions is reviewed. It is suggested that many changes observed during experimental fever result from neurotropic effects of pyrogens. I.S.

A90-22819
THE MINIMAL FRAGMENT OF THE P SUBSTANCE, WHICH RETAINS THE PROPERTIES OF THIS PEPTIDE [MINIMAL'NYI FRAGMENT VESHCHESTVA P, SOKHRANIAIUSHCHII SVOISTVA ETOGO PEPTIDA]
V. P. GOLUBOVICH, S. V. EGOROVA, I. N. OSIPOVICH, E. M. LAZAKOVICH, L. I. KIRNARSKII (AN BSSR, Institut Bioorganicheskoi Khimii, Minsk, Belorussian SSR) et al. Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 309, no. 4, 1989, p. 1000, 1001. In Russian.

Results are presented on modeling the degradation of the P substance (SP: H-Arg-Pro-Lys-Pro-Gln-Phe-Phe-Gly-Leu-Met-NH2) into fragments that could be possibly produced in vivo by blood peptidases, along with the results of biological tests of the model peptides synthesized chemically in vitro. Out of forty-six possible degradation products of SP obtained theoretically, the central-region tetrapeptide SP(6-9) (Gln-Phe-Phe-Gly) was found to be the smallest SP fragment that retained the regulatory activity of smooth musculature. The I-125-labeled SP(6-9) fragments were also found to bind specifically with the NK-1-type SP receptors isolated from cellular membranes. I.S.

A90-22825
CHANGE IN THE POTENTIAL OF THE REDOX STATE OF RAT BRAIN STRUCTURES DURING PARADOXICAL SLEEP [IZMENENIE POTENTSIALA OKISLITEL'NO-VOSSTANOVITEL'NOGO SOSTOIANIIA STRUKTUR GOLOVNOGO MOZGA KRYSY VO VREMIA PARADOKSAL'NOGO SNA]
T. B. SHVETS-TENETA-GURII and K. IU. SARKISOVA (AN SSSR, Institut Vysshei Nervnoi Deiatel'nosti i Neirofiziologii, Moscow, USSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 309, no. 5, 1989, p. 1256-1259. In Russian. refs

A90-23193* Medical Coll. of Wisconsin, Milwaukee.
MORPHOLOGICAL STUDY OF THE INNERVATION PATTERN OF THE RABBIT SINOATRIAL NODE
L. A. ROBERTS, G. R. SLOCUM, and D. A. RILEY (Wisconsin,

Medical College, Milwaukee) *American Journal of Anatomy* (ISSN 0002-9106), vol. 185, 1989, p. 74-88. Research supported by the Medical College of Wisconsin. refs
(Contract NIH-HL-21145; NIH-HL-01795; NAS2-11305)
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The pattern of sinoatrial (SA) node innervations in rabbit was elucidated using a newly developed highly reproducible cholinesterase/silver impregnation staining procedure which made it possible to delineate large nerves, fine processes, and ganglion cells. The SA node and dominant pacemaker sites were identified by microelectrode recording. A generalized pattern of innnervation was recognized, which includes a large ganglionic complex inferior to the SA node; two or more moderately large nerves traversing the SA node parallel to the crista terminalis; nerves entering the intercaval region from the septum, the superior vena cava, and the inferior vena cava to impinge on the SA node; and a fine network of nerve processes, which was particularly dense in the SA node. From the location and distribution of the nerves and ganglionic branches, it can be inferred that the neural network in the intercaval region is capable of performing complex modulatory and integrative functions among the structures within this region. I.S.

A90-23194* Medical Coll. of Wisconsin, Milwaukee.
IN VITRO DIFFERENTIATION OF QUAIL NEURAL CREST CELLS INTO SENSORY-LIKE NEUROBLASTS
MAYA SIEBER-BLUM, SANJIV R. KUMAR, and DANNY A. RILEY (Wisconsin, Medical College, Milwaukee) Developmental Brain Research (ISSN 0165-3806), vol. 39, 1988, p. 69-83. Research supported by the Dysautonomia Foundation. refs
(Contract NIH-HD-21423; NCC2-266)
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Data are presented that demonstrate the ability of quail neural-crest embrionic cells grown as primary culture to differentiate in vitro into sensorylike neuroblasts. After 7-14 days of growth as primary culture, many of the putative sensory neuroblasts displayed substance P (SP)-like immunoreactivity and some exhibited histochemical carbonic anhydrase activity. Double staining experiments showed that the SP-like immunoreactive neuroblasts did not contain detectable levels of tyrosine hydroxylase or dopamine-beta-hydroxylase. The neuronal nature of the cultured sensorylike neuroblasts was further documented by double labeling for antibodies against the 68 kDa neurofilament polypeptide and substance P. I.S.

A90-23369
THE RESPONSE OF LIVING CELLS TO VERY WEAK ELECTRIC FIELDS - THE THERMAL NOISE LIMIT
JAMES C. WEAVER (MIT, Cambridge, MA) and R. DEAN ASTUMIAN (NIST, Gaithersburg, MD) Science (ISSN 0036-8075), vol. 247, Jan. 26, 1990, p. 459-462. refs
(Contract N00014-87-K-0479)
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A physical model in which cells are considered as possible detectors of very weak periodic electric fields yields a general relation between cell size and both thermally induced fluctuations in membrane potential and the maximum change in membrane potential caused by an applied field. The simplest version of the model provides a broad-band estimate of the smallest applied electric field to which membrane macromolecules can directly respond. Much smaller fields can be detected if there is a response in only a narrow band of frequencies or if signal averaging occurs through field-induced variation in the catalytic activity of membrane-associated enzymes. Author

N90-15577*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
EFFECT OF CONTRAST ON THE PERCEPTION OF DIRECTION OF A MOVING PATTERN
L. S. STONE, A. B. WATSON, and J. B. MULLIGAN Dec. 1989 30 p
(NASA-TM-102234; A-89242; NAS 1.15:102234) Avail: NTIS HC A03/MF A01 CSCL 06C

A series of experiments examining the effect of contrast on the perception of moving plaids was performed to test the hypothesis that the human visual system determines the direction of a moving plaid in a two-staged process: decomposition into component motion followed by application of the intersection-of-contraints rule. Although there is recent evidence that the first tenet of the hypothesis is correct, i.e., that plaid motion is initially decomposed into the motion of the individual grating components, the nature of the second-stage combination rule has not yet been established. It was found that when the gratings within the plaid are of different contrast the preceived direction is not predicted by the intersection-of-constraints rule. There is a strong (up to 20 deg) bias in the direction of the higher-constrast grating. A revised model, which incorporates a contrast-dependent weighting of perceived grating speed as observed for one-dimensional patterns, can quantitatively predict most of the results. The results are then discussed in the context of various models of human visual motion processing and of physiological responses of neurons in the primate visual system. Author

N90-15578# Pacific Northwest Lab., Richland, WA.
INTRODUCTION TO EXTREMELY-LOW-FREQUENCY ELECTRIC AND MAGNETIC FIELDS
T. S. TENFORDE Jul. 1989 6 p Presented at the 8th Annual American Statistical Association Conference on Radiation and Health: Health Effects of Electric and Magnetic Fields: Statistical Support for Research Strategies, Cooper Mountain, CO, 9-13 Jul. 1989
(Contract DE-AC06-76RL-01830)
(DE90-002662; PNL-SA-17179; CONF-8907166-1) Avail: NTIS HC A02/MF A01

The interaction with living systems of electromagnetic fields in the extremely-low-frequency (ELF) range below 300 Hz are summarized briefly. In materials with the electrical and magnetic properties of living tissues, these fields have a long wavelength (5000 m) and skin depth (150 m). As a consequence, in their interactions with humans and other living organisms ELF fields behave as though they are composed of independent electric and magnetic components of an ELF field is commonly referred to as the quasi-static approximation, which permits the radiating properties of the field to be neglected in describing its interaction with living organisms. The electric and magnetic components of an ELF field have several distinctly different features in their interactions with humans and other living organisms. First, the electrical conductivity of tissue is approximately 14 to 15 orders of magnitude greater than that of air at ELF electric fields. Consequently, the body behaves like a good electrical conductor in ELF electric fields. As a result, an electrical charge is developed on the surface of a living object in an external ELF field, but the electric field penetrates into the body only to a very limited extent. DOE

N90-16390# Catholic Univ. of America, Washington, DC. Vitreous State Lab.
MECHANISMS OF MICROWAVE INDUCED DAMAGE IN BIOLOGIC MATERIALS Annual Report, 22 Sep. 1986 - 21 Sep. 1987
M. MULLINS, M. PENAFIEL, R. MOHR, C. MONTROSE, T. LITOVITZ, and C. GROSSE Jan. 1988 69 p
(Contract DAMD17-86-C-6260; DA PROJ. 3E1-6277-A-878)
(AD-A213480) Avail: NTIS HC A04/MF A01 CSCL 06/2

An interdisciplinary team of biologists, physicists, and electrical engineers was related to tackle the problem of microwave damage to biological systems. Work is described in five purposely overlapping areas: design and construction of microwave exposure chambers; investigation of the effects of microwave irradiation on the metabolic activity of several cell lines and an interferon system; investigation of the mechanisms of microwave absorption in DNA solutions; theoretical studies of the inhomogeneous deposition of microwave energy in the region of DNA and cells in suspension; and molecular dynamic (MD) computer simulation of electric field effects on long chain (DNA-like) molecules. GRA

N90-16689*# Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.
DYNAMICS OF CARBON DIOXIDE EXCHANGE OF A WHEAT COMMUNITY GROWN IN A SEMI-CLOSED ENVIRONMENT
KENNETH A. COREY *In* University of Central Florida, NASA/ASEE Summer Faculty Fellowship Program p 58-84 Oct. 1989
Avail: NTIS HC A18/MF A03 CSCL 06/2

A wheat (Triticum aestivum Yecora Rojo) community was grown in the semi-closed conditions of the NASA/KSC Biomass Production Chamber (BPC). Experiments were conducted to determine whole community carbon dioxide exchange rates as influenced by growth and development, carbon dixoide concentration, time within the photoperiod, irradiance, and temperature. Plants were grown at a population of about 1500 per sq meter using a 20 hour light/4 hour dark daily regime. Light was supplied by HPS vapor lamps and irradiance was maintained in the range of 590 to 675 mu mol per sq meter. The temperature regime was 20 C light/16 C dark and nutrients were supplied hydroponically as a thin film. Fractional interception of PPF by the community increased rapidly during growth reaching a maximum of 0.96, 24 days after planting. This time corresponded to canopy closure and maximum rates of net photosynthesis (NP). Net daily CO2 utilization rates were calculated to day 48 and a 4th order regression equation integrated to obtain total moles of CO2 fixed by the community. This procedure may be useful for monitoring and prediction of biomass yields in a closed ecology life support system (CELSS). Author

N90-16695*# Purdue Univ., West Lafayette, IN. Dept. of Agricultural Engineering.
PLANT FEATURES MEASUREMENTS FOR ROBOTICS
GAINES E. MILES *In* University of Central Florida, NASA/ASEE Summer Faculty Fellowship Program p 203-225 Oct. 1989
Avail: NTIS HC A18/MF A03 CSCL 06/3

Initial studies of the technical feasibility of using machine vision and color image processing to measure plant health were performed. Wheat plants were grown in nutrient solutions deficient in nitrogen, potassium, and iron. An additional treatment imposed water stress on wheat plants which received a full complement of nutrients. The results for juvenile (less than 2 weeks old) wheat plants show that imaging technology can be used to detect nutrient deficiencies. The relative amount of green color in a leaf declined with increased water stress. The absolute amount of green was higher for nitrogen deficient leaves compared to the control plants. Relative greenness was lower for iron deficient leaves, but the absolute green values were higher. The data showed patterns across the leaf consistent with visual symptons. The development of additional color image processing routines to recognize these patterns would improve the performance of this sensor of plant health. Author

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AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

A90-20024#
SIMULATION OF SPACE-ADAPTATION SYNDROME ON EARTH
W. J. OCKELS (ESTEC, Noordwijk, Netherlands), R. FURRER (Berlin, Freie Universitaet, Federal Republic of Germany), and E. MESSERSCHMID (Stuttgart, Universitaet, Federal Republic of Germany) ESA Journal (ISSN 0379-2285), vol. 13, no. 3, 1989, p. 235-239. Research supported by SRON. refs
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The three Spacelab D-1 Scientist Astronauts were exposed to a 1.5 h centrifuge run in the supine position, resulting in a linear 3 g acceleration. They used their space experience to evaluate their readaptation to normal gravity and compared their observations with 'Space Adaptation Syndrome'. After the centrifuge runs, the vestibular visual system appeared to be modified in a very specific and reproducible manner. Readaptation to the normal 1 g environment took at least 6 h. During this period there was a striking similarity to the astronauts' experience during adaptation to weightlessness in space. Vestibular tests were subsequently performed, which confirmed these subjective findings. Author

A90-20142
THE INFLUENCE OF ALCOHOL AND AGING ON RADIO COMMUNICATION DURING FLIGHT
DANIEL MORROW (Stanford University, CA), JEROME YESAVAGE (Stanford University; USVA, Medical Center, Palo Alto, CA), and VON LEIRER (Decision Systems, Inc., Stanford, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Jan. 1990, p. 12-20. refs
(Contract PHS-AA-07035)
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This study finds that alcohol and pilot age impair radio communication during simulated flight. Young (mean age 25 years) and older (mean age 42 years) pilots flew in a light aircraft simulator during alcohol and placebo conditions. In the alcohol condition, pilots drank alcohol and flew after reaching 0.04 percent BAC, after reaching 0.10 percent BAC, and then 2, 4, 8, 24, and 48 h after they stopped drinking at 0.10 percent BAC. Alcohol and age impaired communication-based and overall flying performance during and immediately after drinking. Older pilots were more impaired by alcohol. Notably, performance was as impaired 2 h after reaching 0.10 percent BAC as it was at 0.10 percent BAC. Moreover, overall performance was impaired for 8 h after reaching 0.10 percent BAC. Author

A90-20143
RAPID DECOMPRESSION OF A TRANSPORT AIRCRAFT CABIN - PROTECTION AGAINST HYPOXIA
H. MAROTTE, C. TOURE, J. M. CLERE, and H. VIEILLEFOND (Centre d'Essais en Vol, Bretigny-Air, France) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Jan. 1990, p. 21-27. refs
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The hypoxic hazard after rapid decompression in transport aircraft was evaluated as a function of the current means of protection, including the role of the inhaled oxygen fraction prior to decompression. The decompressions were made in 2 s; the initial altitude was 8000 ft and the final altitude was 16,000-45,000 ft. The physiological measurements were arterial oxygen saturation, heart rate, ventilatory frequency, and gaseous analysis in the mask. Results show that the inhaled oxygen fraction prior to decompression is not very significant, but the delay before donning the oxygen system seems to be the most limiting factor against tolerance to hypoxia. Author

A90-20145* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.
EFFECT OF A CENTRAL REDISTRIBUTION OF FLUID VOLUME ON RESPONSE TO LOWER-BODY NEGATIVE PRESSURE
CLARE M. TOMASELLI, MARY A. B. FREY, RICHARD A. KENNEY, and G. WYCKLIFFE HOFFLER (NASA, Kennedy Space Center; Bionetics Corp., Cocoa Beach, FL; George Washington University, Washington, DC) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Jan. 1990, p. 38-42. refs
Copyright

Cardiovascular responses to lower-body negative pressure (LBNP) were studied following 1 hour of 6-deg head-down tilt to determine whether a redistribution of blood volume toward the central circulation modifies the subsequent response to orthostatic stress. Responses of 12 men, ages 30-39 years, were evaluated by electrocardiography, impedance cardiography, sphygmomanometry, and measurement of calf circumference. During the LBNP that followed head-down tilt, as compared with

control LBNP (no preceding head-down tilt) subjects, had smaller stroke volume and cardiac output, greater total peripheral resistance, and less calf enlargement. These differences reflect differences in the variables immediately preceding LBNP. Magnitudes of the responses from pre-LBNP to each pressure stage of the LBNP procedure did not differ between protocols. Mean and diastolic arterial pressures were slightly elevated after LBNP-control, but they fell slightly during LBNP post-tilt. Author

A90-20146
HEARING LOSS AND RADIOTELEPHONY INTELLIGIBILITY IN CIVILIAN AIRLINE PILOTS
G. W. VAN DEELEN and J. H. BLOM (National Aerospace Medical Centre, Soesterberg, Netherlands) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Jan. 1990, p. 52-55.
Copyright

Airline pilots with a mild to moderate hearing loss are regularly examined in the Netherlands National Aerospace Medical Center. The maximal discrimination of phonetically balanced monosyllable words (20 word lists) in 16 airline pilots (32 ears) with such a hearing loss varies between 65-100 percent. However, none of these pilots complains of a bad speech-intelligibility in the cockpit. This may indicate that there is a poor relation between the routine speech discrimination and the speech intelligibility in the working situation. A 'speech-audiometric' test (RT-test) was developed, which is completely based on the aviation jargon used in radiotelephony (RT) communications. In a group of 16 pilots, the maximal discrimination in the RT-test was excellent. Even for ears with a maximal discrimination of 65-70 percent in the routine speech-audiometric test, the maximal RT-discrimination was 99-100 percent. These pilots were all very experienced (average: 14,360 flying hours). Undoubtedly, this experience is of great importance in radiotelephony-intelligibility. Author

A90-20147
THE USE OF TYMPANOMETRY IN PREDICTING OTITIC BAROTRAUMA
DEANA H. ASHTON and LAURANCE A. WATSON (Royal Australian Air Force, Institute of Aviation Medicine, Point Cook, Australia) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Jan. 1990, p. 56-61. refs
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Static acoustic impedance tympanometry was used to examine 80 subjects prior to and after exposure to decreased ambient pressure in a hypobaric chamber. The predictive value of tympanometry in detecting those individuals likely to suffer from otitic barotrauma (aerotitis media) was evaluated. The results suggest that testing prior to altitude exposure is of no value in identifying those individuals who will suffer from otitic barotrauma during flight. Tympanometry however proved a useful tool in confirming the presence of barotrauma following flight, but it was no more useful than taking a history and performing an ear examination. Author

A90-20148
TUMBLING AND SPACEFLIGHT - THE GEMINI VIII EXPERIENCE
STANLEY R. MOHLER, ARNAULD E. T. NICOGOSSIAN, PERCIVAL D. MCCORMACK, and STANLEY R. MOHLER, JR. Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Jan. 1990, p. 62-66. refs
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A malfunctioning orbital flight attitude thruster during the flight of Gemini VIII led to acceleration forces on astronauts that created the potential for derogation of oculo-vestibular and eye-hand coordination effects. The spacecraft attained an axial tumbling rotation of 50 rpm, and by the time counter-measure controls were applied, both astronauts were experiencing vertigo and the physiological effects of the tumbling acceleration. Data from the recorders reveal that one astronaut experienced -Gy of 0.92 G-units, and the other +Gy of 0.92 for approximately 46 s. Both received a -Gz of 0.89 G-units from the waist up with a +Gz of 0.05 from the waist down. A substantial increase of time and/or an increase in rpm would ultimately have produced incapacitation of both astronauts. NASA corrected the Gemini thruster problem by changing the ignition system wiring. Future spacecraft undertaking long-term missions could be equipped with unambiguous thruster fault display and computer-controlled automatic cutoffs to control excessive thruster burns. Author

A90-20981* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
EXERCISE-TRAINING PROTOCOLS FOR ASTRONAUTS IN MICROGRAVITY
J. E. GREENLEAF (NASA, Ames Research Center, Moffett Field, CA), R. BULBULIAN (California, University, Davis), E. M. BERNAUER (Stanford University, CA), W. L. HASKELL (Kentucky, University, Lexington), and T. MOORE (Methodist Hospital, Indianapolis, IN) Journal of Applied Physiology (ISSN 0161-7567), vol. 67, Dec. 1989, p. 2191-2204. refs
Copyright

Based on physical working requirements for astronauts during intra- and extravehicular activity and on the findings from bed-rest studies that utilized exercise training as a countermeasure for the reduction of aerobic power, deterioration of muscular strength and endurance, decrements in mood and cognitive performance, and possibly for bone loss, two exercise protocols are proposed. One assumes that, during microgravity, astronaut exercise physiological functions should be maintained at 100 percent of ground-based levels. The other assumes that maximal aerobic power in flight can be reduced by 10 percent of the ground-based level. Author

A90-20982
EFFECTS OF ALTITUDE ACCLIMATIZATION ON PULMONARY GAS EXCHANGE DURING EXERCISE
D. E. DEBOUT, D. STORY, J. ROCA, M. C. HOGAN, D. C. POOLE (California, University, La Jolla) et al. Journal of Applied Physiology (ISSN 0161-7567), vol. 67, Dec. 1989, p. 2286-2295. refs
(Contract NIH-HL-17731; NIH-M01-RR-00827)
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Pulmonary gas exchange was studied in eight normal subjects both before and after 2 wk of altitude acclimatization at 3,800 m. Respiratory and multiple inert gas tensions, ventilation, cardiac output, and hemoglobin concentration were measured at rest and during three levels of constant-load cycle exercise during both normoxia and normobaric hypoxia. After acclimatization, the measured alveolar-arterial PO2 difference for any given work rate decreased. It is suggested that the reduction is a result of nearly complete alveolar/end-capillary diffusion equilibration on the basis of a longer pulmonary capillary transit time. Author

A90-21851
CHARACTERISTICS OF THE OXYGEN-TRANSPORT FUNCTION OF ERYTHROCYTES DURING ACUTE ALTITUDE HYPOXIA [OSOBENNOSTI KISLORODTRANSPORTNOI FUNKTSII ERITROTSITOV PRI OSTROI VYSOTNOI GIPOKSII]
L. V. FILEV, V. I. MAZUROV, S. F. ENOKHIN, and D. I. KOROTKOV Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Oct. 1989, p. 39-42. In Russian. refs
Copyright

The effect of acute altitude hypoxia (AAH) on the content of hemoglobin (Hb) in erythrocytes and on the regulators of Hb's oxygen affinity (such as changes in the Hb structure, the pH, the CO2 tension in blood, and the erythrocyte content of 2,3-diphosphoglycerate) were investigated in healthy humans some of whom spent 48 hours in an altitude chamber at 4000 m, while others spent from 1 to 12 days at an altitude of 3200 m after a rapid ascent. It was found that an increase of methemoglobin (MetHb) content in erythrocytes, observed within the first 48 hours of AAH, was the earliest index of the AAH effect, followed by an increase in HbF. It is suggested that measurements of MetHb and HbF can be used as quantitative measures of the ability to adapt to AAH. I.S.

A90-21852
CAUSES OF THE DECLINE IN THE STATE OF WELL-BEING IN PILOTS DURING FLIGHT. II [PRICHINY UKHUDSHENIIA SAMOCHUVSTVIIA LETCHIKOV V POLETE]
V. E. IASTREBOV and V. V. SHCHERBINSKII Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Oct. 1989, p. 43-45. In Russian. refs
Copyright

Factors involved in the decline of the general state of well-being in pilots during prolonged flights are investigated. Physiological symptoms encountered in the so-called triple-functional syndrome (which includes vagotonia, spasmophylia, and functional hypoglycemia) affecting pilots during flights are described together with psychological factors responsible for the decline of well-being. Special attention is given to the conditions of flight which can affect the functioning of a pilot. I.S.

A90-21909* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
EFFECT OF LOWER-BODY POSITIVE PRESSURE ON POSTURAL FLUID SHIFTS IN MEN
H. HINGHOFER-SZALKAY, S. E. KRAVIK, and J. E. GREENLEAF (NASA, Ames Research Center, Moffett Field, CA) European Journal of Applied Physiology (ISSN 0301-5548), vol. 57, 1988, p. 49-54. refs
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The effect of the lower-body positive pressure (LBPP) on the orthostatic fluid and protein shifts were investigated in five men during combined tilt-table/antigravity suit inflation and deflation experiments. Changes in the mass densities of venous blood and plasma were measured and the values were used to calculate the densities of erythrocytes, whole-body blood, and shifted fluid. It was found that the application of 60 mm Hg LBPP during 60-deg head-up tilt prevented about half of the postural hemoconcentration occurring during passive head-up tilt. I.S.

A90-22740
BIORHYTHMOLOGY AND CHRONOTHERAPY (CHRONOBIOLOGY AND CHRONOBALNEOTHERAPY) [BIORITMOLOGIIA I KHRONOTERAPIIA /KHRONOBIOLOGIIA I KHRONOBAL'NEOFIZIOTERAPIIA/]
IGOR' E. ORANSKII and PETR G. TSARFIS Moscow, Izdatel'stvo Vysshaia Shkola, 1989, 160 p. In Russian. refs
Copyright

The effect of the periodicity of natural phenomena (such as the diurnal light-darkness and atmospheric electricity cycles and seasonal weather and geomagnetic-activity changes) on the functioning of the human organism is examined. Particular attention is given to the effect of the disruption of the biological synchrony of an organism by an abrupt transfer to a different time zone or natural rhythm, such as happens in long-distance transmeridian flights or in shift work, and to chronotherapeutic methods used to prevent the desynchronization of the biological rhythms due to such changes. The principles involved in the design of chrono-physiotherapy and chronobalneotherapy in correcting the condition of desynchronization of various physiological processes are discussed, and the beneficial effects of such treatments are illustrated with clinical data. I.S.

A90-22801
DYNAMICS OF THE ENERGY CHARACTERISTICS OF THE HUMAN ORGANISM DURING TRANSMERIDIONAL TRAVELS [DINAMIKA ENERGETICHESKIKH KHARAKTERISTIK ORGANIZMA PRI TRANSMERIDIANNYKH PEREMESHCHENIIAKH CHELOVEKA]
S. G. KRIVOSHCHEKOV, P. M. SHMERLING, A. M. PICHKUROV, and IU. A. TATAUROV (AMN SSSR, Institut Fiziologii, Novosibirsk, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 15, Nov.-Dec. 1989, p. 56-61. In Russian. refs
Copyright

The effect of transmeridional flights on the efficiency of muscular work and the functional indices of the cardiorespiratory system during rest and physical work were investigated. It was found that, in resting subjects, the cardiorespiratory indices measured after a return to the original time zone after a 28-day long stay in a different time zone (with a change of three hours in the eastern direction) were not different from the background values. On the other hand, in the first days of readaptation, the indices of the muscular-system energy measured during muscular work were found to be lower than those of controls, reflecting a state of desynchronization between the endogenic rhythms and external time monitors. I.S.

A90-22802
THE REGULATING AND ACTIVATING ROLE OF THE PORTAL VESSEL SYSTEM IN THE SUPPORT OF HOMEOSTASIS IN HUMANS SUBJECTED TO THERMAL STRESS [REGULIRUIUSHCHAIA I AKTIVIZIRUIUSHCHAIA ROL' PORTAL'NOI SOSUDISTOI SISTEMY CHELOVEKA V PODDERZHANII GOMEOSTAZA PRI TEPLOVOM STRESSE]
G. D. LIAKH (Institut Kraevoi Patologii, Alma-Ata, Kazakh SSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 15, Nov.-Dec. 1989, p. 62-71. In Russian. refs
Copyright

A90-22803
ELEVATED SKIN TEMPERATURE AS A CRITERION OF ADAPTATION TO THE HIGH TEMPERATURE OF AN ARID ZONE [POVYSHENNAIA TEMPERATURA KOZHI KAK KRITERII ADAPTATSII K VYSOKOI TEMPERATURE ARIDNOI ZONY]
M. D. KHUDAIBERDIEV (AN TSSR, Institut Fiziologii i Eksperimental'noi Patologii Aridnoi Zony, Ashkhabad, Turkmen SSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 15, Nov.-Dec. 1989, p. 78-82. In Russian. refs
Copyright

The skin-temperature values in the armpit, forehead, thorax, leg, and hand areas of human subjects residing in a hot climatic region were measured during various seasons of the year. Results showed that, during the hot summer season, skin temperatures increased in general (with the highest increases recorded for the skin of extremities), while the gradient between the temperatures of the extremities and that of the thorax decreased, indicating the existence of stress in the thermoregulatory system. I.S.

A90-22804
CHANGES IN THE CONDITION OF ADRENORECEPTORS IN MOUNTAIN DWELLERS WITH DEXTRAVENTRICULAR HYPERTROPHY [IZMENENIIA SOSTOIANIIA ADRENORETSEPTOROV U GORTSEV S GIPERTROFIEI PRAVOGO ZHELUDOCHKA]
A. A. ALDASHEV, U. M. BORBUGULOV, B. A. DAVLETOV, and T. S. MEIMANALIEV (Kirgizskii Nauchno-Issledovatel'skii Institut Kardiologii, Frunze, Kirgiz SSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 15, Nov.-Dec. 1989, p. 138-140. In Russian. refs
Copyright

The effect of chronic altitude hypoxia on the condition of lymphocytic beta-adrenoreceptors was investigated in natives of eastern Pamir (3600-4200 m above sea level) who were healthy or suffered from dextraventricular hypertrophy. It was found that the density of beta-adrenoreceptors on the lymphocytes of mountain dwellers suffering from dextraventricular hypertrophy was significantly lower than in controls, with the density decreases being proportional to the level of hypertrophy. In addition, hypertrophic subjects exhibited characteristics of beta-receptor uncoupling with adenylcyclase. I.S.

A90-22805
THE INFLUENCE OF POSTURE ON THE THERMOREGULATORY ACTIVITY OF SHOULDER MUSCLES [VLIIANIE POZY NA TERMOREGULIATSIONNUIU AKTIVNOST' MYSHTS PLECHA]
A. IU. MEIGAL and G. I. KUZ'MINA (Petrozavodskii Gosudarstvennyi Universitet, Petrozavodsk, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 15, Nov.-Dec. 1989, p. 147-149.

In Russian. refs
Copyright

Changes of the thermoregulatory activity (TA) of the shoulder musculature in humans due to changes in the position of the body (from lying down to sitting to standing) and of arms (relative to the shoulder and the elbow joints) were investigated in subjects who were stripped to the waist and remained at 17-18 C air temperature. The TA of the shoulder musculature was estimated by registering the number of motion units (MUs) in the tricept and the bicept muscles by means of an electromyograph. The pattern of the TA of these antagonist muscles was found to be related to the position of the body and the upper extremities. I.S.

A90-22858
EFFECTS OF AMINAZIN, CAFFEINE, AND MENTAL-LOAD INTENSITY ON THE PSYCHOPHYSIOLOGICAL FUNCTIONS AND WORK EFFICIENCY OF HUMANS [VLIIANIE AMINAZINA, KOFEINA I INTENSIVNOSTI UMSTVENNOI NAGRUZKI NA PSIKHOFIZIOLOGICHESKIE FUNKTSII I EFFEKTIVNOST' RABOTY CHELOVEKA]
A. O. NAVAKATIKIAN and A. G. GRIGORUS' (Institut Gigieny Truda i Profzabolevanii, Kiev, Ukrainian SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 35, no. 6, 1989, p. 79-83. In Russian. refs
Copyright

The effects of depressing (by aminazin) and activating (by caffeine) the central nervous system (CNS) activity of humans engaged in mental work were investigated in subjects who were presented with information at three different speeds and were asked to respond to these signals. The results of measurements of the psychophysiological indices showed that an increased activation of CNS increases the efficiency of subjects engaged in low-speed mental work, but increases the probability of errors at the higher speeds. Lowering the CNS activity with aminazin did not depress the ability of subjects to identify signals, but inhibited the speed of their decisions. The effect of the CNS activation and mental load was found also to depend on the subject's working routine and on his individual peculiarities. I.S.

N90-15579# JIL Systems, Inc., Arlington, VA.
DOCTORD DATABASE SYSTEM USER'S GUIDE, JUNE 1989: DBASE 3 PLUS PHYSICIAN/(PART B MEDICARE): PERSONAL COMPUTER REFERENCE SYSTEM AND USER'S GUIDE
JUDITH STEVENSON, JIM MELENDEZ, and JULIE WALTON Jun. 1989 151 p
(Contract HCFA-500-87-0005)
(PB90-100181; HCFA/DF/DK-90/001A) Avail: NTIS HC A08/MF A01 CSCL 05B

The DOCTORD System is based on a dBase 3 PLUS database which contains information on completed and active physician and other Part B studies, projects and reports sponsored by ORD. Its function is to act as a reference tool to assist management is accessing past studies and tracing present ones. The DOCTORD System is run by a menu-driven applications program, which allows the user to perform such tasks as appending new records, searching for specific data and printing out abstracts and indexes. The program is designed to make using the system as easy as possible; the manual provides detailed instructions and examples to illustrate how the system should be operated. GRA

N90-15580# Los Alamos National Lab., NM. Center for Nonlinear Studies.
MONITORING CHAOS OF CARDIAC RHYTHMS
GOTTFRIED MAYER-KRESS 1989 10 p Presented at BIOTECH USA: 6th Annual Industry Conference and Exhibition, San Francisco, CA, 2-4 Oct. 1989
(Contract W-7405-ENG-36)
(DE90-000692; LA-UR-89-3192; CONF-8910223-1) Avail: NTIS HC A02/MF A01

Chaos theory provides a new paradigm in monitoring complexity changes in heart rate variability. Even in cases where the spectral analysis only shows broad band characteristics, estimations of dimensional complexity parameters can show quantitative changes in the degree of chaos present in the interbeat interval dynamics. We introduce the concept of dimensional complexity as a dynamical monitoring parameter and discuss its properties in connection with control data and data taken during cardiac arrest. Whereas dimensional complexity provides a quantitative indicator of overall chaotic behavior, recurrence plots allow direct visualization of recurrences in arbitrary high dimensional pattern-space. In combination these two methods from non-linear dynamics exemplify a new approach in the problem of heart rate monitoring and identification of precursors of cardiac arrest. Finally we mention a new method of chaotic control, by which selective and highly effective perturbations of nonlinear dynamical systems could be used for improved pacing patterns. DOE

N90-15581# Krug International, San Antonio, TX. Technology Services Div.
POTENTIAL FOR REDUCTION OF DECOMPRESSION SICKNESS BY PREBREATHING WITH 100 PERCENT OXYGEN WHILE EXERCISING Interim Report
JAMES T. WEBB, GENE A. DIXON (School of Aerospace Medicine, Brooks AFB, TX.), and JANET F. WIEGMAN 1989 7 p
(Contract F33615-85-C-4503)
(AD-A213449; USAFSAM-JA-89-21) Avail: NTIS HC A02/MF A01 CSCL 06/10

Exercise performed for at least 30 min while prebreathing 100 percent oxygen prior to decompression was reported to increase efficiency of denitrogenation by 100 to 500 percent. The incidence of decompression sickness following such a prebreathe was decreased by 50 percent compared to resting prebreathe. If prebreathing with exercise is to have an operational application, it must be brief, it must significantly reduce standard prebreathing times, it must not create excess fatigue, and it must use exercise equipment compatible with aerospace operations. This article provides background and recommends parameters for a test to determine the operational feasibility of prebreathing with exercise. GRA

N90-15582# Rockefeller Univ., New York, NY.
CARBOXYALKYLATED HEMOGLOBIN AS A POTENTIAL BLOOD SUBSTITUTE Annual Report, 1 Sep. 1988 - 31 Aug. 1989
JAMES M. MANNING 20 Sep. 1989 20 p
(Contract DAMD17-88-C-8169)
(AD-A213886) Avail: NTIS HC A02/MF A01 CSCL 06/1

Emphasis was on two major objectives. First, the properties were characterized of the carboxymethyl derivative of hemoglobin to determine whether they are consistent with its possible future use as a blood substitute. Evidence was found that this derivative is analogous to that formed in the reaction of hemoglobin with CO2. This natural product results in a very low oxygen affinity for hemoglobin, which is a very desirable property for a blood substitute. The second major objective of the research was to crosslink this hemoglobin derivative in a manner that will maintain the essential functional properties of hemoglobin. GRA

N90-15583# Wright State Univ., Dayton, OH.
USE OF LOWER BODY NEGATIVE PRESSURE AS A COUNTERMEASURE TO NEGATIVE GZ ACCELERATION Final Report, Dec. 1987 - Dec. 1989
BRADLEY GERARD BECK and LLOYD D. TRIPP, JR. (Aerospace Medical Research Labs., Wright-Patterson AFB, OH.) Apr. 1989 108 p
(Contract AF PROJ. 7231)
(AD-A213927; AAMRL-TR-89-025) Avail: NTIS HC A06/MF A01 CSCL 06/10

Lower body negative pressure (LBNP) was used at levels of 0, -50, and -100 torr as a countermeasure prior to centrifuge exposures of subjects to negative Gz at levels of -1.0, -1.5, and -2.0. EKG, echocardiographic, and subjective data were gathered. Physiological variables for end diastolic volume (EDV), end systolic volume (ESV), stroke volume (SV), heart rate (HR), and cardiac output (CO) were obtained at baseline values, then percent of baseline after LBNP was started, then during the -Gz exposure

plateau. ANOVA revealed that the LBNP main effects were significant for EDV, ESV, SV, and HR (p is less than .0027). The negative Gz main effects were not significant for EDV, ESV, and SV (p is greater than .3821), but were significant for HR and CO (p is less than .0001). Paired T-tests showed the LBNP of -50 and -100 torr lessened the HR changes during -Gz as compared to 0 LBNP (p is less than .0199). LBNP retained its effects for EDV, ESV, HR, and CO (p is less than .0017). The subjective results showed pairwise differences (p = .0312) in ratings between -2.0 Gz exposure unprotected and -2.0 Gz protected for facial congestion, sinus pain, and degree of comfort. Overall rankings of exposures also demonstrated that LBNP protected against negative Gz effects at p = .028. GRA

N90-16391*# National Aeronautics and Space Administration. Pasadena Office, CA.
APPARATUS FOR IMAGING DEEP ARTERIAL AND CORONARY LESIONS Patent Application
JAMES A. ROONEY, inventor (to NASA), RICHARD C. HEYSER, inventor (to NASA), and DENNIS H. LECROISSETTE, inventor (to NASA) 1 Dec. 1989 24 p
(Contract NAS7-918)
(NASA-CASE-NPO-17439-1-CU; NAS 1.71:NPO-17439-1-CU; US-PATENT-APPL-SN-444248) Avail: NTIS HC A03/MF A01 CSCL 06/2

A reflection-mode ultrasonic system uses time-delay spectrometry (TDS) for imaging of variations in a property of deep arterial and coronary tissue within a volume at a range from a transmitting transducer. A receiving transducer mounted concentric with the transmitting transducer provides a return signal that is demodulated by the sweep of the TDS using a balanced mixer to present a complex signal representative of a property within a volume of tissue. The complex signal is amplified and filtered before mixing with a frequency signal from a local generator to establish a zero range reference for A-scan display of the return signal, but before display the offset return signal is transformed by a fast Fourier transform processor from the frequency domain to a time domain to present the return signal for display as a time-based range signal. A B-scan display may be provided by additionally scanning the transducers in a linear path across the tissue. NASA

N90-16392# Army Aeromedical Research Lab., Fort Rucker, AL. Biodynamics Research Div.
SIMULATOR SICKNESS IN THE UH-60 (BLACK HAWK) FLIGHT SIMULATOR Final Report
DANIEL W. GOWER, JR. and JENNIFER FOWLKES (Essex Corp., Orlando, FL.) Sep. 1989 75 p
(AD-A214434; USAARL-89-25) Avail: NTIS HC A04/MF A01 CSCL 06/10

The U.S. Army Aeromedical Research Laboratory conducted field studies of operational flight simulators to assess the incidence and severity of simulator sickness. Simulator sickness here refers to the constellation of motion sickness related symptoms that occur in simulators due to visual representation, motion base representation, or combination of the two representations of flight. The incidence rates and relative frequency of specific symptoms are presented. Correlational factors such as recent simulator experience, current state of health, overall flight expereience, mission scenario, and flight dynamics are presented. The Army's flight simulators are ranked in comparision to the 10 Navy simulators studied by the Naval training systems Center, Orlando, Florida. The study further reinforces the need for studies to understand perceptual rearrangement, adaptation/readaptation, and pilot susceptibility to the effects of simulation. Design criteria for simulators, as well as those training guidelines necessary to cope with this phenomenon also must be addressed. GRA

N90-16393# Oak Ridge National Lab., TN. Health and Safety Research Div.
SHORT-TERM BIOASSAYS MAY BE USEFUL IN EVALUATING FIBER/WHISKER HAZARDS
CLAY E. EASTERLY Nov. 1989 27 p Presented at the ANSI Subcommittee Meeting, Orlando, FL, 28-29 Nov. 1989
(Contract DE-AC05-84OR-21400)
(DE90-003707; CONF-8911148-1-VUGRAPHS) Avail: NTIS HC A03/MF A01

The utility of short-term bioassays for predicting hazards has been the focus of many individual efforts in the past. The World Health Organization concludes that a combination of tests may be useful in detecting excess formation of fibrous tissue in the lung as a result of reparative or reactive processes. Further, some consistency has been observed between specific in vitro assays and the induction of mesotheliomas induced in in vivo assays. For the most part such studies of correlation were very qualitative and were performed using mechanistic concepts to match the in vitro studies with whole animal studies. An alternative method to viewing the in vitro to in vivo correlation will be presented in this talk. Much of the focus will be on work performed by L. R. Glass during his dissertation research. Based on the alternative method, a plan for testing this concept on fibers will be presented. The abstract is this paper's only text; the remainder consists of viewgraphs. DOE

N90-16693*# North Carolina Univ., Greensboro. Dept. of Mathematics.
FACTOR ANALYTIC REDUCTION OF THE CAROTID-CARDIAC BAROREFLEX PARAMETERS
DAVID A. LUDWIG *In* University of Central Florida, NASA/ASEE Summer Faculty Fellowship Program p 159-170 Oct. 1989
Avail: NTIS HC A18/MF A03 CSCL 06/16

An accepted method for measuring the responsiveness of the carotid-cardiac baroreflex to arterial pressure changes is to artificially stimulate the baroreceptors in the neck. This is accomplished by using a pressurized neck cuff which constricts and distends the carotid artery and subsequently stimulates the baroreceptors. Nine physiological responses to this type of stimulation are quantified and used as indicators of the baroreflex. Thirty male humans between the ages 27 and 46 underwent the carotid-cardiac baroreflex test. The data for the nine response parameters were analyzed by principle component factor analysis. The results of this analysis indicated that 93 percent of the total variance across all nine parameters could be explained in four dimensions. Examination of the factor loadings following an orthogonal rotation of the principle components indicated four well defined dimensions. The first two dimensions reflected location points for R-R interval and carotid distending pressure respectively. The third dimension was composed of measures reflecting the gain of the reflex. The fourth dimension was the ratio of the resting R-R interval to R-R interval during simulated hypertension. The data suggests that the analysis of all nine baroreflex parameters is redundant. Author

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BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

A90-21457
VISUAL INTERACTIONS WITH LUMINANCE AND CHROMATIC STIMULI
G. R. COLE, C. F. STROMEYER, III, and R. E. KRONAUER (Harvard University, Cambridge, MA) Optical Society of America, Journal, A: Optics and Image Science (ISSN 0740-3232), vol. 7, Jan. 1990, p. 128-140. refs
(Contract NIH-EY-01808; AF-AFOSR-86-0338)
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The visibility of a 1 deg, 200-msec flash on a large yellow field is measured as a function of the intensity of a coincident pedestal flash (a flash that is the same in both temporal intervals of a two-alternative forced-choice trial). The various flashes are

incremental (+Lum) or decremental (-Lum) yellow luminance flashes or green (+Chr) or red (-Chr) isoluminant chromatic flashes. With uncrossed conditions (Lum tests on Lum pedestals or Chr tests on Chr pedestals) the conventional dipper function is obtained, that is, the function of threshold test intensity is highly asymmetric about zero pedestal intensity, and strong pedestals induced strong masking. Crossed conditions produce neither effect; with Chr tests on Lum pedestals, there is no dipper function. Instead, the suprathreshold luminance pedestals facilitate chromatic detection by as much as two to three times and also linearizes the chromatic psychometric function, further enhancing sensitivity to weak chromatic stimuli. S.A.V.

A90-21458
EYE MOVEMENTS AND OPTICAL FLOW
WILLIAM H. WARREN, JR. and DANIAL J. HANNON (Brown University, Providence, RI) Optical Society of America, Journal, A: Optics and Image Science (ISSN 0740-3232), vol. 7, Jan. 1990, p. 160-169. refs
(Contract NIH-AG-05223)
Copyright

Translation of an observer through a static environment generates a pattern of optical flow that specifies the direction of self-motion, but the retinal flow pattern is confounded by pursuit eye movements. How does the visual system decompose the translational and rotational components of flow to determine heading? It is shown that observers can perceive their direction of self-motion during stationary fixations and pursuit eye movements and with displays that simulate the optical effects of eye movements. Results indicate that the visual system can perform the decomposition with both continuous and discontinuous fields on the basis of flow-field information alone but requires a three-dimensional environmental structure to do so. The findings are inconsistent with general computational models and theories based on the maximum of divergence, oculomotor signals, or multiple fixations but are consistent with the theory of reliance on differential motion produced by environmental variation in depth. Author

A90-21525
DOES THE BRAIN KNOW THE PHYSICS OF SPECULAR REFLECTION?
ANDREW BLAKE (Oxford, University, England) and HEINRICH BULTHOFF (Brown University, Providence, RI) Nature (ISSN 0028-0836), vol. 343, Jan. 11, 1990, p. 165-168. Research supported by the U.S. Navy and SERC. refs
Copyright

It is reported that the three-dimensional appearance of a highlight on a computer-simulated stereoscopic curved surface affects observers' judgment of surface gloss. It is also shown that the three-dimensional appearance of a highlight affects the perception of surface curvature, i.e., it can force an ambiguous convex-concave figure to change state. It is concluded that human visual analysis seems to employ a physical model of the interaction of light with curved surfaces, a model firmly based on ray optics and differential geometry. C.D.

A90-22859
DIURNAL VARIATIONS IN THE EFFICIENCY OF THE OPERATOR-TYPE MENTAL ACTIVITY DURING SHIFT WORK [SUTOCHNYE IZMENENIIA EFFEKTIVNOSTI UMSTVENNOI DEIATEL'NOSTI OPERATORSKOGO TIPA PRI SMENNOM REZHIME TRUDA]
N. A. BOBKO (Kievskii Institut Gigieny Truda i Profzabolevanii, Kiev, Ukrainian SSR) Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 35, no. 6, 1989, p. 83-87. In Russian. refs
Copyright

The existence and the type of diurnal variations in the efficiency of mental activity in operators engaged in shift work were investigated. The average-group data did not exhibit significant diurnal variations in the indices of mental activity, although there was a tendency to an increased quality of task execution at 8 AM as compared with that recorded at 4 PM and midnight. However, a survey of individual data detected the presence of significant diurnal variability with respect to the speed of operations in 15 percent of the operators, indicating an insufficient adaptation ability in these subjects. I.S.

A90-23292
PSYCHOLOGICAL FACTORS IN REMOTE SENSING - A REVIEW OF SOME RECENT RESEARCH
ROBERT R. HOFFMAN (Adelphi University, Garden City, NY) and JANE CONWAY (Sonalysts, Inc., Waterford, CT) Geocarto International (ISSN 1010-6049), vol. 4, Dec. 1989, p. 3-21. refs
Copyright

Psychological research relevant to remote sensing is reviewed, focusing on the problems of eliciting and characterizing the knowledge of expert data interpreters and the best utilization of color in remote sensing displays. Methods of psychological research are outlined and compared, noting the importance of certain types of research for remote sensing studies. Issues related to data interpretation include the data flow rate bottleneck, the knowledge acquisition bottleneck, the training bottleneck, and the need for human input into interpretation. Research related to color coding in informational displays includes the problem of choosing a color set, the difficulties in using color to code information, and issues related to the choice of color codings. R.B.

N90-15584# Chief of Naval Education and Training Support, Pensacola, FL.
HUMAN BEHAVIOR
May 1989 163 p
(PB90-780008; NAVEDTRA-10058-C1) Avail: NTIS HC A08/MF A01 CSCL 05/9

A basic presentation is given of human behavior theory and utilization techniques as applied to basic assumptions about human behavior and motivation, the influence of perception, the effects of stress and conflict on human reactions, the formation and influence of attitudes, communication, problem solving, and teaching learning. Human behavior is designed to serve as a basic course on leadership concepts and principles for senior enlisted personnel, especially those in paygrades E-6, E-7, E-8, and E-9, who spend most of their time in supervisory duties. Author

N90-15585# Idaho National Engineering Lab., Idaho Falls.
MODEL FOR MEASURING COMPLEX PERFORMANCE IN AN AVIATION ENVIRONMENT
HEIDI ANN HAHN 1988 5 p Presented at the 32nd Human Factors Society Annual Meeting, Anaheim, CA, 24-28 Oct. 1988 Previously announced in IAA as A89-31648 Sponsored in part by AF
(Contract DE-AC07-76ID-01570)
(DE90-002055; EGG-M-88271; CONF-881058-5) Avail: NTIS HC A01/MF A01

An experiment was conducted to identify models of pilot performance through the attainment and analysis of concurrent verbal protocols. Sixteen models were identified. Novice and expert pilots differed with respect to the models they used. Models were correlated to performance, particularly in the case of expert subjects. Models were not correlated to performance shaping factors (i.e., workload). DOE

N90-15586# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, ID.
WHERE TO FROM HERE. FUTURE APPLICATIONS OF MENTAL MODELS OF COMPLEX PERFORMANCE
HEIDI ANN HAHN, WILLIAM R. NELSON, and HAROLD S. BLACKMAN 1988 2 p Presented at the Human Factors Society Annual Meeting, Anaheim, CA, 24-28 Oct. 1988
(Contract DE-AC07-76ID-01570)
(DE90-002091; EGG-M-88288; CONF-881058-7) Avail: NTIS HC A02/MF A01

The purpose of this paper is to raise issues for discussion regarding the applications of mental models in the study of complex performance. Applications for training, expert systems and decision

aids, job selection, workstation design, and other complex environments are considered. DOE

N90-15587# Maryland Univ., College Park. Center for Automation Research.
VISION IN DYNAMIC ENVIRONMENTS Final Report
AZRIEL ROSENFELD 15 Aug. 1989 27 p
(Contract DAAB07-86-K-F073)
(AD-A213434) Avail: NTIS HC A03/MF A01 CSCL 23/3

Research conducted on the contract was primarily concerned with real-time, three-dimensional computer vision and image understanding. Abstracts include: Tracing Finite Motions without Correspondence; Group Theoretical Methods in Image Understanding; Interpreting Aerial Photographs by Segmentation and Search; Straight Line Fitting in a Noisy Image; Calibration of a Stereo System with Small Relative Angles; Cylindrical Shape from Contour and Shading without Knowledge of Lighting Conditions or Surface Albedo; A Robust Algorithm for Determining the Translation of a Rigidly Moving Surface without Correspondence, for Robotics Applications; Finding Motion Parameters from Spherical Flow Fields (Or the Advantages of Having Eyes in the Back of your Head). GRA

N90-15588# Washington Univ., Saint Louis, MO.
THE ROLE OF ATTENTION IN VISUAL PROCESSING Progress Report
GORDON L. SHULMAN 1989 4 p
(Contract N00014-89-J-1426)
(AD-A214158) Avail: NTIS HC A02/MF A01 CSCL 06/4

This is the first reported instance in which attention modulates the strength of a visual aftereffect and supports the basic idea underlying the grant: that one can use adaptation phenomena to relate the action of attention to specific visual mechanisms. If one views an object on a monitor whose direction of rotation is specified through perspective, then a subsequent object presented without perspective, whose direction of rotation is normally ambiguous, will be seen to rotate in the opposite direction. Adapting to the unambiguous stimulus has desensitized mechanisms specific for a particular direction of rotation in depth. Data indicating that the extent to which this adaption process occurs depends on the extent to which the adapting stimulus is attended. This result suggests that the mechanisms that are being adapted in these experiments are also capable of being attentionally influenced. GRA

N90-15589# Rochester Univ., NY. Dept. of Computer Science.
AN ARCHITECTURAL MODEL OF VISUAL MOTION UNDERSTANDING Ph.D. Thesis
THOMAS JEREMY OLSON Aug. 1989 151 p
(Contract N00014-84-K-0655; DACA76-85-C-0001)
(AD-A214327; TR-305) Avail: NTIS HC A08/MF A01 CSCL 12/9

The past few years have seen an explosion of interest in the recovery and use of visual motion information by biological and machine vision systems. In the area of computer vision, a variety of algorithms were developed for extracting various types of motion information from images. The central claim is that many puzzling aspects of motion perception can be understood by assuming a particular architecture for the human motion processing system. The architecture consists of three functional units or subsystems. The first or low level subsystem computes simple mathematical properties of the visual signal. It is entirely bottom-up, and prone to error when its implicit assumptions are violated. The intermediate-level subsystem combines the low-level system's output with world knowledge, segmentation information and other inputs to construct a representation of the world in terms of primitive forms and their trajectories. In order to compute the trajectories of primitive shapes it is necessary to design mechanisms for handling time and Gestalt grouping effects in connectionist networks. Solutions to these problems are developed and used to construct a network that interprets continuous and apparent motion stimuli in a limited domain. Simulation results show that its interpretations are in qualitative agreement with human perception. GRA

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

A90-20149
EVALUATION OF THREE COMMERCIAL MICROCLIMATE COOLING SYSTEMS
BRUCE S. CADARETTE, KAREN L. SPECKMAN, MICHAEL N. SAWKA (U.S. Army, Research Institute of Environmental Medicine, Natick, MA), and BARRY S. DECRISTOFANO (U.S. Army, Research, Development and Engineering Center, Natick, MA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, Jan. 1990, p. 71-76. refs
Copyright

Three commercially available microclimate cooling systems were evaluated for their ability to reduce heat stress by measuring physiological responses of human subjects equipped with the ILC Dover Model 19 Coolvest (ILC), LSSI Coolhead (LSSI), or Thermacor Cooling Vest (Therm) and exercising at 38 C. Results of the endurance time, heart rate, rectal temperature, mean skin temperature, sweating rate, rated perceived exertion, and thermal sensation measurements showed an improved physiological response with all three commercial systems, with the greatest benefit in performance time provided by the ILC cooling system. I.S.

A90-20552
AUTOMATION IN NAVIGATION AND ITS CONSEQUENCES FOR MAN-MACHINE INTERACTIONS [L'AUTOMATISATION EN NAVIGATION ET SES CONSEQUENCES SUR LES RAPPORTS ENTRE L'HOMME ET LA MACHINE]
COSTANTINO PETROSELLINI Navigation (Paris) (ISSN 0028-1530), vol. 37, Oct. 1989, p. 503-511. In French.
Copyright

An attempt is made to define problems connected with man-machine interactions in the context of the modern cockpit. It is suggested that the loss of contact with external reality, associated with operational difficulties of the systems, requires new types of training methods and new and standardized data display and command procedures. B.J.

A90-21302
PROBABILISTIC CHARACTERISTIC OF THE FUNCTIONAL RELIABILITY OF MAN-MACHINE SYSTEMS WITH ALLOWANCE FOR POSSIBLE FAILURES [VEROIATNOSTNAIA KHARAKTERISTIKA NADEZHNOSTI FUNKTSIONIROVANIIA ERGATICHESKIKH SISTEM V USLOVIIAKH VOZMOZHNYKH OTKAZOV]
L. N. DEGTIARENKO and V. N. PANFEROV (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 80, 1988, p. 31-34. In Russian. refs
Copyright

The hierarchy of possible failures in the functioning of man-machine systems is analyzed. An expression is obtained for determining the intensity of failures in the system, and the relationship between the internal and external failures is examined. The discussion is illustrated by an example dealing with aircraft control. V.L.

A90-21303
STRUCTURE OF THE MENTAL REPRESENTATION OF MANUAL CONTROL TASKS BY HUMAN OPERATORS [*STRUKTURA VNUTRENNIKH OPISANII CHELOVEKOM* ZADACH RUCHNOGO UPRAVLENIIA]
V. A. CHERNOMORETS (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 80, 1988, p. 37-41. In Russian. refs
Copyright

The manual control of dynamic systems by human operators is examined as a system of elementary control cycles whose different combinations constitute the structure of different manual control procedures. The main activity of human operators is related to the preparation of initial data and decision making. In addition to the simple perception of external information, the operator processes it together with other available data, forming a mental description of a control task. A phenomenological approach to the identification of the general principles of the formation of a mental representation of manual control tasks is proposed. V.L.

A90-21304
PARTIAL DECOMPOSITION OF A STOCHASTIC SYSTEM MODEL IN A MAN-MACHINE CONTROL SYSTEM [CHASTICHNAIA DEKOMPOZITSIIA STOKHASTICHESKOI MODELI OB'EKTA V ERGATICHESKOI SISTEME UPRAVLENIIA]
V. P. KOSHLAK, M. A. PRIMIN, and V. A. IATSENKO (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 80, 1988, p. 45-50. In Russian. refs
Copyright

The objective of the study was to develop a simplified mathematical model of the visual situation in an operator training system. A solution is obtained in the form of a system of stochastic differential equations that allow partial decomposition. The solution employs continuous integration over the diffusion process paths together with some results of the group theory of differential equations. V.L.

A90-21305
MODELING OF THE DETECTION OF UNFORESEEABLE SITUATIONS BY AN OPERATOR [MODELIROVANIE PROTSESSA OBNARUZHENIIA OPERATOROM NEPREDVIDENNYKH SITUATSII]
V. E. KABIKIN (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 80, 1988, p. 55-60. In Russian.
Copyright

The ability of the human operator to distinguish between dynamic control systems with very similar main characteristics was investigated experimentally. An attempt to represent this process in algorithmic form yielded two models of the operator's behavior. One model is based on the assumption that the principal factor controlling the operator's behavior is the mismatch error. In the other model, the difference between the expected and actual image is considered to be the main factor. V.L.

A90-21307
PARALLEL STRATEGY FOR MATCHING THE CHARACTERISTICS OF A MAN-MACHINE SYSTEM [PARALLEL'NAIA STRATEGIIA SOGLASOVANIIA KHARAKTERISTIK SISTEMY CHELOVEK-MASHINA]
D. I. PALEICHUK (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 80, 1988, p. 74-76. In Russian.
Copyright

A method for distributing the functions and matching the characteristics of the human operator and automatic control devices in man-machine systems is proposed which uses generalized performance characteristics of the human operator. The function selection and characteristic matching is accomplished using the maximum performance margin of the operator as the main criterion. A schematic diagram of a parallel control system is presented. V.L.

A90-21308
DATA REPRESENTATION AND POTENTIAL FUNCTIONS IN A CLASS OF MAN-MACHINE SYSTEMS [OTOBRAZHENIE INFORMATSII I POTENTSIAL'NYE FUNKTSII V ERGATICHESKIKH SISTEMAKH ODNOGO KLASSA]
V. V. PAVLOV and A. M. MELESHEV (AN USSR, Institut Kibernetiki, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 80, 1988, p. 76-79. In Russian.
Copyright

The possibilities of increasing the efficiency of the human operator in a class of man-machine systems in which the computer does the bulk of 'mental' work is examined. The effectiveness of using potential functions for representing control data on a display for the human operator is demonstrated. Examples of such data representations are given. V.L.

A90-21309
OPERATING ALGORITHMS FOR MULTILEVEL MAN-MACHINE CONTROL SYSTEMS [ALGORITMY FUNKTSIONIROVANIIA MNOGOUROVNEVYKH ERGATICHESKIKH SISTEM UPRAVLENIIA]
L. M. ARTIUSHIN, K. V. EREMIN, and A. I. ROMASHEVSKII (Kievskoe Vysshee Voennoe Aviatsionnoe Inzhenernoe Uchilishche, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 80, 1988, p. 80-84. In Russian. refs
Copyright

An approach to the synthesis of operating algorithms for multilevel man-machine control systems is proposed which is based on the method of inverse dynamics problems. The structure of an operating algorithm for a two-level control system is presented, and it is shown how this structure can be combined with the structures of control algorithms for the servo mechanisms. V.L.

A90-21310
AN INDEX OF PILOT WORKLOAD [OB ODNOM POKAZATELE UROVNIA OPERATSIONNOI NAPRIAZHENNOSTI PILOTA]
V. A. KONDRATENKOV (Kievskoe Vysshee Voennoe Aviatsionnoe Inzhenernoe Uchilishche, Kiev, Ukrainian SSR) Kibernetika i Vychislitel'naia Tekhnika (ISSN 0454-9910), no. 80, 1988, p. 96-98. In Russian. refs
Copyright

Knowledge of the pilot workload directly related to flight control functions is essential for optimizing the system pilot-flight vehicle. Here, a method for estimating the pilot workload is proposed which is based on a statistical analysis of the correcting component of the stochastic lever manipulation process. The pilot workload index proposed here can be used to estimate the degree of difficulty of any operator control task. V.L.

A90-21633
INVASION OF THE SPACEBOTS
GREG FREIHERR Air and Space (ISSN 0886-2257), vol. 4, Feb.-Mar. 1990, p. 72-81.
Copyright

NASA-Goddard is the lead development center for robotic devices that will help assemble, service, and repair the planned NASA Space Station. Goddard's efforts currently extend to what may be the first practical space robot, the Flight Telerobotic Servicer. The EVA Retriever, under construction at the Johnson Space Center, will be able to fetch either tools or astronauts that come to be unsafely separated from the Station. Trully pathbreaking robotic systems are exemplified by the 15 ft-tall, six-legged 'Ambler' planetary terrain-walker, and the 'DataSuit' and 'DataGlove' garments with integrated fiber-optic sensors; when the data they generate are connected to a visual representation of a three-dimensional space, the wearer can interact with the simulated environment. O.C.

A90-22151*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
A PRELIMINARY ANALYSIS OF ADVANCED LIFE SUPPORT SYSTEMS FOR MANNED MARS MISSIONS
PAUL F. WERCINSKI and KENJI NISHIOKA (NASA, Ames Research Center, Moffett Field, CA) AIAA, Aerospace Sciences Meeting, 28th, Reno, NV, Jan. 8-11, 1990. 11 p. refs
(AIAA PAPER 90-0003) Copyright

This paper outlines the key parameters of the manned mission to Mars and presents some top-level requirements, issues, and constraints associated with a manned Mars mission that impact the life support system (LSS). Results are presented of a preliminary analysis for advanced LSSs based on physical/chemical reclamation processes, using as a baseline for the analysis the mission profile of a Split-Sprint class mission for an arrival date at Mars in the year 2009. Special attention is given to the potential cost savings as measured by reducing Mars spacecraft mass in LEO. I.S.

A90-23262#
GRAPHIC-SIMULATOR-AUGMENTED TELEOPERATION SYSTEM FOR SPACE APPLICATIONS
KAZUO MACHIDA, YOSHITSUGU TODA, and TOSHIAKI IWATA (Electrotechnical Laboratory, Tsukuba, Japan) Journal of Spacecraft and Rockets (ISSN 0022-4650), vol. 27, Jan.-Feb. 1990, p. 64-69. Previously cited in issue 21, p. 3580, Accession no. A88-50200. refs
Copyright

A90-23483
A HYPOTHESIS EVALUATION MODEL FOR HUMAN OPERATORS
DAVID D. SWORDER and KARYN S. HAALAND (California, University, La Jolla) IEEE Transactions on Systems, Man, and Cybernetics (ISSN 0018-9472), vol. 19, Sept.-Oct. 1989, p. 1091-1100. refs
(Contract N66001-85-D-0203; NSF ECS-86-07816)
Copyright

A study of a model that portrays the response of a person given a situation-assessment task is presented. The model is expressed in terms of stochastic differential equations in order that it be compatible with the usual modeling paradigm for describing dynamically varying situations. The measured response of a test subject has been compared with a sample response of the model. The subject was presented with a time-varying scene and was asked to indicate the level of confidence that a target was within the field of view. This along with the actual locations of targets and decoys, was recorded and compared with the model response to the same scenario. The model did not reproduce the observed behavior pattern just as two humans would not respond identically to the same stimuli. Nevertheless, the model does manifest the 'human' indecisiveness found in the experiment. I.E.

N90-15060# Army Aeromedical Research Lab., Fort Rucker, AL. Aviation Research and Development Activity.
IMAGING PROBABILITIES, GEOMETRY AND ERGONOMICS IN LIMITED VISIBILITY HELICOPTER OPERATIONS
ROBERT H. WRIGHT *In* AGARD, Flight in Adverse Environmental Conditions 11 p Sep. 1989
Copyright Avail: NTIS HC A17/MF A03; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Helicopter pilots using night vision systems have a low probability of seeing the best visual cues that are available for flight control. Even with good visual range, the forward view of current night vision systems looks where visual cues are geometrically insensitive to changes in vehicle states and motions. At terrain flight heights, best visual cues reflecting vehicle states and motions are located directly below the helicopter. As visual range attenuates, the best vision of the terrain retreats toward the same angles below the helicopter where the best flight control cues are found. Image and symbolic cues of night vision systems both preclude effective use of normal spatial-motion visual perception, which quickly processes the entire visual array in parallel with no or very low workload. Downward viewing display concepts should allow normal spatial-motion vision to function effectively, resulting in major reductions in pilot workload and training requirements, and safer flight control with poor visibility. At terrain flight heights most tactical visual cues are visually compressed in elevation angle within just a few degrees at the horizon, but are widely dispersed in azimuth. Terrain obstacles to safe flight are also located within a few degrees of the horizon, but are well defined in azimuth by the velocity vector. It is concluded night vision systems could be improved by designing to better exploit geometric characteristics of visual cues and normal pilot spatial-motion visual processes. Author

N90-15590 Maryland Univ., College Park.
THE APPLICATION OF OPTIMAL CONTROL THEORY FOR ANALYSIS OF HUMAN JUMPING AND PEDALING Ph.D. Thesis
EUNSUP SIM 1988 204 p
Avail: Univ. Microfilms Order No. DA8912351

Human jumping and pedaling are analyzed using optimal control theory. The human body is mechanically modeled as 3 rigid links with 8 group muscles for each leg and 1 rigid link for the upper body. The jumps which maximize the vertical height reached by the subject's center of mass while jumping from an initial squat posture or an erect posture are studied. The pedaling process is a bicycle-rider system. The rider's hips are fixed on the saddle, the feet are rigidly attached to the pedals and the upper body is stationary. So, the process is modeled as 2-five bar linkages moving in the plane, fixed at the hip joint and at a crank axis. The performance criterion is minimization of the time required for one cycle of the crank. The system is described mathematically by nonlinear differential equations which are linear in the controls. The system equations consist of limb mechanics, muscle dynamics and muscle activation dynamics. The optimal control is assumed to be of bang-bang type with a finite number of switchings. A new computation algorithm for bang-bang control of these highly nonlinear and large scale dynamic systems is developed. The controls are determined by using the projection of the gradient of the cost function with respect to the control input switching times on the control Hamiltonian function of the system. The controls maximize this Hamiltonian function, holding the state and costate trajectories fixed. An optimization algorithm to get the best values for unknown initial state variables on a constraint set defined by linear equalities and inequalities is developed. The necessary conditions for optimal control of a redundant dynamic system and a reduced dynamic system to represent the pedaling process are developed. This along with the algorithm for bang-bang control is used to obtain the optimal control inputs of the pedaling process. The computational results for human jumping are compared with experimental results. Dissert. Abstr.

N90-15591*# Massachusetts Inst. of Tech., Cambridge. Dept. of Applied Biological Sciences.
UTILIZATION OF NON-CONVENTIONAL SYSTEMS FOR CONVERSION OF BIOMASS TO FOOD COMPONENTS
M. KAREL and Z. NAKHOST Dec. 1989 37 p
(Contract NCC2-231)
(NASA-CR-177545; NAS 1.26:177545) Avail: NTIS HC A03/MF A01 CSCL 06/6

Described here is work accomplished in investigating the potential use of micro-algae in yielding useful macronutrients for closed ecological life support systems in space habitats. Analysis of the chemical composition of the blue-green alga Synechoccus 6311 was done in the present work, and was compared to values found in previous work on the green algae Scenedesmus obliquus. Similar values were obtained for proteins, and lower values for nucleic acids and lipids. A second part of the work involved fabrication of food products containing various levels of incorporated algae (S. obliquus) proteins and/or lipids. Protein isolate was incorporated into a variety of food products such as bran muffins, fettuccine (spinach noodle imitation), and chocolate

chip cookies. In the sensory analysis, the greenish color of the bran muffins and cookies was not found to be objectionable. The mild spinachy flavor was less detectable in chocolate chip cookies than in bran muffins. The color and taste of the algae noodles were found to be pleasant and compared well with commercially available spinach noodles. Author

N90-15592# Anacapa Sciences, Inc., Fort Rucker, AL.
DEVELOPMENT OF THE AH-64 DISPLAY SYMBOLOGY TRAINING MODULE Interim Report, Dec. 1986 - Apr. 1989
JOHN W. RUFFNER, GARY W. COKER, and RICHARD D. WEETER Aug. 1989 337 p
(Contract MDA903-87-C-0523)
(AD-A213456; ASI690-322-89; ARI-RN-89-41) Avail: NTIS HC A15/MF A02 CSCL 05/8

To become fully qualified in the AH-64A attack helicopter, a student aviator must learn to identify and interpret the individual symbols presented on the helicopter's visual displays and to interpret the information provided by groups of symbols. A training module for teaching aviators to identify and interpret the symbology used on the AH-64A visual displays is described. The training module, known as the Symbology Tutor, consists of an introductory section, a help system, and five lessons that provide instruction on the symbols contained in the AH-64A flight symbology set. The lessons cover symbols dealing with: (1) position and movement, (2) attitude and altitude, (3) heading and navigation, (4) cueing and reference, and (5) weapons usage. Each lesson is divided into a tutorial and a quiz. Storyboards were developed for each of the five lessons and are included in the appendixes. Computer programs were completed for the first two lessons. The completed portions of the Symbology Tutor is described and the required computer hardware is identified. GRA

N90-15593# Dynamics Research Corp., Wilmington, MA.
MANPRINT METHODS MONOGRAPH: AIDING THE DEVELOPMENT OF MANNED SYSTEM PERFORMANCE CRITERIA Final Report, Nov. 1986 - May 1987
JONATHAN D. KAPLAN Jun. 1989 269 p
(Contract MDA903-86-C-0412; MDA903-86-C-0414; MDA903-86-C-0416)
(AD-A213543) Avail: NTIS HC A12/MF A01 CSCL 23/2

This monograph consists of three papers on a common subject: The development of complete, rigorous, and operationally measurable performance criteria for manned systems. Each of these papers presents a concept for building an aiding method. The U.S. Army Research Institute for the Behavioral and Social Sciences began the program to develop methods to integrate available operations and maintenance personnel with hardware and software. The first stage of this process was to develop three alternate, competitive concepts for each method. The three concept papers in this monograph were written in response to requirements for a method to develop rigorous and ultimately measurable performance criteria. These criteria would enable hardware and software designers to better understand what a manned, fully integrated system would have to do to achieve operations and maintenance success. Success would be described in terms of required performance levels of operations and maintenance tasks under specified conditions. The concept papers written in response to this requirement have three significantly different focuses and bring powerful but different approaches to the problem of developing rigorous and meaningful performance criteria. Ultimately, the ARI study advisory group decided to implement the concept proposed by Micro-Analysis and Design. GRA

N90-15594# Dayton Univ., OH.
COCKPIT RESOURCE MANAGEMENT: A SELECTED ANNOTATED BIBLIOGRAPHY Interim Report, Jul. 1987 - May 1989
H. KINGSLEY POVENMIRE Oct. 1989 52 p
(Contract F33615-84-C-0066; F33615-87-C-0012)
(AD-A214272; UDR-TR-88-104; AFHRL-TR-89-22) Avail: NTIS HC A04/MF A01 CSCL 05/9

The concepts of cockpit resource management (CRM) emerged during a 1979 study by the National Aeronautics and Space Administration which was intended to study the interaction of pilot workload with errors. During this study, researchers began to realize that the stereo-typical airline captain who can do no wrong was not feasible in today's complex jet aircraft. Several accidents and incidents may be traced directly to improper crew management or lack of coordination by the crew. NASA began to explore the feasibility of teaching generic management principles to flight crews. Several training programs have been developed, and some significant research has been conducted which further defines optimum CRM training and practice. Line-Oriented Flight Training (LOFT) is a training method developed originally to relate simulator training more closely to actual line flying. Airlines found that they could enhance the sharing of experiences by simulating an entire flight, complete with incidents experienced in the real world, rather than repeated malfunctions taken out of context. It is important to note that LOFT is often utilized by airlines and other simulator users without employing the principles of CRM. However, LOFT is a valuable tool in CRM training. This bibliography addresses current training practices, techniques which enhance crew coordination, and questions appropriate for systematic research. GRA

N90-15976# Glavkosmos, Moscow (USSR).
EVA SPACE SUIT. GENERAL CONCEPTS OF DESIGN AND ARRANGEMENT
G. I. SEVERIN, V. I. SVERTSHEK, and I. P. ABRAMOV *In* ESA, Crew Safety and Rescue in Space: An International Approach p 13-17 Aug. 1989
Copyright Avail: NTIS HC A04/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 30 Dutch guilders

The Extra Vehicular Activities (EVA) space suit, used by the Soviets, is presented. It is a semi-rigid type of suit. High reliability of a space suit and its subsystems and an adequate cosmonaut mobility are considered in the space suit development process. Space suit system design concepts and associated study results are reviewed. Methods to provide space suit reliability are presented. ESA

N90-16394# Department of the Navy, Washington, DC.
HELMET-MOUNTED HEAD RESTRAINT Patent Application
MICHAEL H. PATTERSON, inventor (to Navy) 3 Nov. 1988 12 p
(AD-D014233; US-PATENT-APPL-SN-266955) Avail: NTIS HC A03/MF A01 CSCL 06/11

A head restraint for the occupant of a vehicle seat is disclosed, which restrains the forward and downward movement of the occupant's head when subjected to large deceleration forces. The restraint includes a strap assembly which encircles the back of the occupant's head and releasably connects to his helmet adjacent to each of his ears at two locations. A retaining strap is slidably connected by a loop to the strap assembly and extends behind the head to a retracting means fixed in the seat. The retracting means pulls the head back against the seat when the deceleration forces exceed a predetermined level, as during flight maneuvers. During normal flight conditions, the occupant is able to move his head freely from side to side as the strap assembly slides through the loop. GRA

N90-16395# Decision Science Consortium, Inc., Reston, VA.
USER INTERACTION WITH SELF-LEARNING SYSTEMS Final Report, Dec. 1988 - Jul. 1989
MARTIN A. TOLCOTT, PAUL E. LEHNER, and THERESA M. MULLIN Aug. 1989 81 p
(Contract F33615-88-C-0540)
(AD-A214280; AAMRL-TR-89-029) Avail: NTIS HC A05/MF A01 CSCL 12/9

This research investigated how users interact with an expert system in which underlying values change as a function of the situation or of the planning time horizon. The problem context was the prioritization of tactical air strike targets, and Air Force targeteers were the experimental subjects. Their task was to explain why the system made the recommendations it did. The expert system was simulated in storyboard form. It was found that users

who were given a good conceptual model of the expert system, in the form of a brief summary of its step-by-step processes, performed better than those whose model of the system was relatively poor. Users whose displays were relatively user-oriented (geographic, top-down, and simplified) did not consistently differ in performance from users whose displays were relatively aid-oriented (data-intensive matrices). However, the aid-oriented displays seem to encourage users to make more frequent reference to three tables (available to all subjects) containing important information about the expert assessments on which the aid's algorithms operated. Users would typically generate their own solutions, using criteria and heuristics that often differed from those used by the aid, and question the expert system solution. GRA

N90-16396# Royal Aerospace Establishment, Farnborough (England).
KEEPING THE PILOT IN THE LOOP
R. G. WHITE Feb. 1989 20 p Presented at Flight Deck Display and Pilot Performance, Bedford, England, 4 Apr. 1989
(RAE-TM-FM-18; BR109681; ETN-90-96131) Copyright Avail: NTIS HC A03/MF A01

Evaluation of pilot performance is investigated. Questions concerning ways of informing the pilot when a problem arises and ways to show him that he must develop a solution are discussed. The manifestation of this dilemma at different stages in the history of flight, and cockpit systems needed to tackle it, are analyzed. The need for a totally integrated avionic system incorporating automatic monitoring and a suite of integrated displays is demonstrated. ESA

N90-16397 Ludwig-Maximilians-Universitaet, Munich (Germany, F.R.). Inst. fuer Medizinische Psychologie.
ASSESSMENT OF VISUAL FUNCTION IN AEROSPACE MEDICINE Final Report
INGO RENTSCHLER, HANS STRASBURGER, BERNHARD TREUTWEIN, and WALTER ENCKE Feb. 1989 143 p In GERMAN; ENGLISH summary
(Contract BMVG-INSAN-I-0784-V-6385; BMVG-INSAN-I-0784-V-6386)
(BMVG-FBWM-89-5; ETN-90-95872) Copyright Avail: Dokumentations- und Fachinformationszentrum der Bundeswehr, Friedrich-Ebert-Allee 34, 5300 Bonn, Federal Republic of Germany

Three aspects of visual function in aerospace environments are investigated. The recognition of digital displays in the cockpit, the analysis of temporal visual processing in aerospace medicine, and the implementation of a user friendly system for the psychophysical analysis of visual function in aerospace medicine, are discussed. It is concluded that digital displays should not be used for monitoring signals in the cockpit. Two techniques for analyzing deficiencies in the visual capacity to process temporal information are presented. A direct dialog between user and computer is measured using a statistically optimal procedure of maximum likelihood parameter estimation. ESA

N90-16398# Dornier System G.m.b.H., Friedrichshafen (Germany, F.R.). Dept. of Environmental Control and Life Support Systems.
DNSS: GERMAN/NORWEGIAN WORK TEAM SPACE SUBSEA. ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEMS (TECHNICAL MATTERS), PHASE 2 Final Report
INGO BORCHERS, INGO DATHE, JOSEF HACKSTEIN, ANDREAS KREIS, HELMUT PREISS, MARION STIEB-STABEL, and RAINER STOEPLER Oct. 1987 12 p In GERMAN; ENGLISH summary
(Contract BMFT-FE-01-TQ-8602-AK/PA1)
(ETN-90-95905) Avail: NTIS HC A03/MF A01

Monitoring and control methods used to avoid microbiological contamination in the Hermes and Columbus programs are discussed. A critical analysis of the components of the environmental control and life support subsystem is presented. Components of the environmental control and life support system were the main noise sources in the Spacelab project. Analytical investigations concerning noise production for a variable speed fan are presented. Primary and secondary noise sources are taken into account in optimizing noise reduction. A universal test bench used to verify the analytical data is presented. ESA

N90-16399*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
A SPACE-TIME DISCRETIZATION PROCEDURE FOR WAVE PROPAGATION PROBLEMS
SANFORD DAVIS Nov. 1989 42 p
(NASA-TM-102215; A-89212; NAS 1.15:102215) Avail: NTIS HC A03/MF A01 CSCL 20/14

Higher order compact algorithms are developed for the numerical simulation of wave propagation by using the concept of a discrete dispersion relation. The dispersion relation is the imprint of any linear operator in space-time. The discrete dispersion relation is derived from the continuous dispersion relation by examining the process by which locally plane waves propagate through a chosen grid. The exponential structure of the discrete dispersion relation suggests an efficient splitting of convective and diffusive terms for dissipative waves. Fourth- and eighth-order convection schemes are examined that involve only three or five spatial grid points. These algorithms are subject to the same restrictions that govern the use of dispersion relations in the constructions of asymptotic expansions to nonlinear evolution equations. A new eighth-order scheme is developed that is exact for Courant numbers of 1, 2, 3, and 4. Examples are given of a pulse and step wave with a small amount of physical diffusion. Author

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SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

A90-20176
BIOGENESIS BY COMETARY GRAINS - THERMODYNAMIC ASPECTS OF SELF-ORGANIZATION
FRANZ R. KRUEGER (Ingenieurbureau Krueger, Darmstadt, Federal Republic of Germany) and JOCHEN KISSEL (Max-Planck-Institut fuer Kernphysik, Heidelberg, Federal Republic of Germany) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 19, no. 2, 1989, p. 87-93. Research supported by BMFT. refs
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From the analysis of composition and structure of cometary grains some thermodynamic aspects concerning biogenesis arose. Assuming any kind of hypercyclic organization as the first step that came into existence spontaneously, some prerequisites are necessary from thermodynamics of irreversible processes, e.g., large concentration gradients of certain substances and high affinities of their reactions catalyzed at surfaces, small semipermeable compartments due to the related diffusion coefficients, and large reservoirs of substrates and for products. Neither an isothermal dilute-soup nor a cometary pond scenario can probably meet these requirements. However, cometary grains as found in p/Halley added to an aqueous solution of nutrient organics on earth may fulfill the requirements of chemical thermodynamics (two types of matter on very different chemical potential at the same place and time) to start molecular self-organization. As the probability of the survival of some cometary matter during atmospheric entry is regarded to be not low if deep lakes or an ocean collect the cometary pieces, this scenario could provide a model of origin of life. Author

A90-20178
THE GAMMA-IRRADIATION OF AQUEOUS SOLUTIONS OF UREA - IMPLICATIONS FOR CHEMICAL EVOLUTION
R. NAVARRO-GONZALEZ, A. NEGRON-MENZODA, and E. CHACON (Universidad Nacional Autonoma de Mexico, Coyoacan,

Mexico) Origins of Life and Evolution of the Biosphere (ISSN 0169-6149), vol. 19, no. 2, 1989, p. 109-118. refs
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0.05 mole/cu dm O2-free aqueous solutions of urea were studied after receiving various doses of C0-60 gamma rays (0.14-600 kGy). Urea was found to be relatively stable under radiation; its radiation chemical yield of decomposition was 0.47. Hydrogen (G = 0.50), carbon dioxide (G = 0.44), ammonia (G = 0.22), oxalic acid (G = 0.0054), malonic acid (G = 0.000064) and three unidentified oligomers were found to be the main radiolytic products. The origin of these products is explained by free radical reactions initiated by the transients from water radiolysis. Author

A90-21924
WAS RNA THE FIRST GENETIC POLYMER?
LESLIE E. ORGEL (Salk Institute for Biological Studies, San Diego, CA) IN: Evolutionary tinkering in gene expression. New York, Plenum Publishing Corp., 1989, p. 215-224. refs
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A recently proposed hypothesis (e.g., Westheimer, 1986) that a primitive organism based on RNA (and using catalytic RNAs as enzymes) but lacking proteins is the ancestor all living things is discussed in the framework of the consequences of this hypothesis from the viewpoint of chemical evolution of life. Five logically coherent scenarios are discussed, which are obliged to assign to chemical entities properties that they seem unlikely to possess, or to postulate stereospecific synthetic pathways which seem implausible in a prebiotic context. One of these involves prebiotic monomers, simpler than the ribonucleotides, that can generate replicating catalytic polymers and a subsequent transition from the simpler polymers to RNA, without the loss of catalytic function. Another scenario involves stereospecific catalytic clays or catalytic organic-inorganic coprecipitates that can replicate. I.S.

N90-16400*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
COMPUTATION OF THE UNSTEADY FACILITATED TRANSPORT OF OXYGEN IN HEMOGLOBIN
SANFORD DAVIS Jan. 1990 33 p
(NASA-TM-102251; A-90011; NAS 1.15:102251) Avail: NTIS HC A03/MF A01 CSCL 06/3

The transport of a reacting permeant diffusing through a thin membrane is extended to more realistic dissociation models. A new nonlinear analysis of the reaction-diffusion equations, using implicit finite-difference methods and direct block solvers, is used to study the limits of linearized and equilibrium theories. Computed curves of molecular oxygen permeating through hemoglobin solution are used to illustrate higher-order reaction models, the effect of concentration boundary layers at the membrane interfaces, and the transient buildup of oxygen flux. Author

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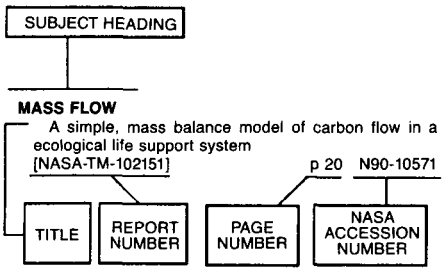

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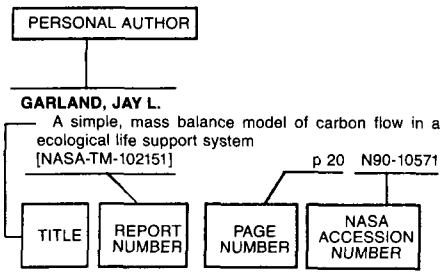

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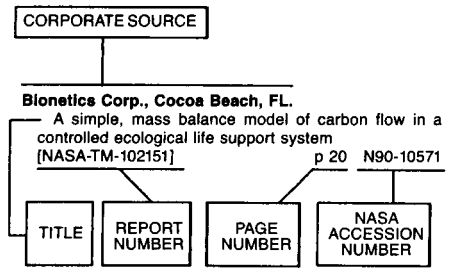

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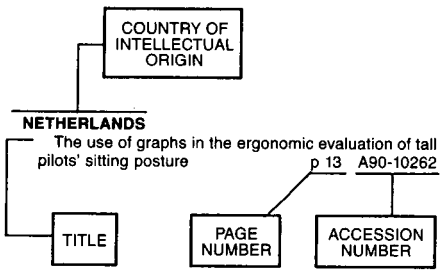

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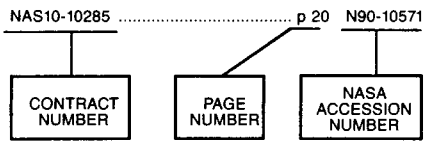

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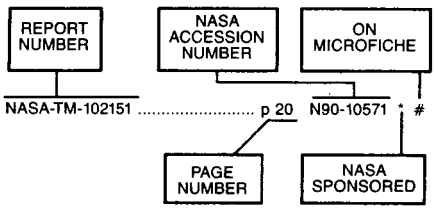

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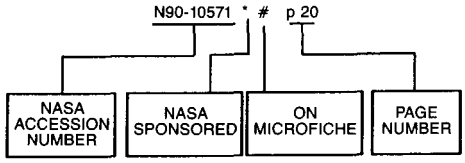

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